(12) UK Patent Application (19) GB (11) 2 238 405 (13) A

(43) Date of A publication 29.05.1991

(21) Application No 9019977.9

(22) Date of filing 12.09.1990

(30) Priority data

(31) 01239337	(32) 14.09.1989	(33) JP
01108674	19.09.1989	
01254753	29.09.1989	
01116898	04.10.1989	
01141734	06.12.1989	
02006707	16.01.1990	

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(51) INT CL[5]
G05B 11/32 13/02 // A01G 25/16, A47F 11/06, F24F 11/00 G02B 27/18, G05D 23/19, G10K 15/04, H05B 37/02

(52) UK CL (Edition K)
G3N NGBB3 NGCA N262 N272X N287
G5C CAC
U1S S1340 S1931 S1945 S1967 S1978

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(58) Field of search
UK CL (Edition K) **G3N NGBA NGBB3 NGBX NGCA NGE1 NGL**
Online database: WPI

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(54) Environmental control system for creating comfortable space

(57) Environmental control in a windowless building measures indoor factors including temperature, human activity and human body temperature and simulates the outdoor environment. As well as air conditioning control, which may be general or local to a particular work area, the system may generate ambient sound (fig 4), simulate outdoor rainfall, level and colour of illumination and humidity (figs 5 to 7), project coloured lighting or images (figs 8 and 9) or generate aromas. Outdoor scenes may be generated using false windows (figs 10 to 12). The scenes may be coordinated along a succession of windows (figs 15-16) and may be animated. Alternatively, images of model objects may be projected (figs 18 to 20). The auxiliary wall housing the false window structures may contain ducting for air-conditioning. Human activity may be detected using cameras with picture analysis, skin reflectivity, radar, door operation, speech or an ID card which serves as a transmitter. The system is said to provide an optimum combination of the controlled factors to give the greatest degree of comfort.

FIG.1

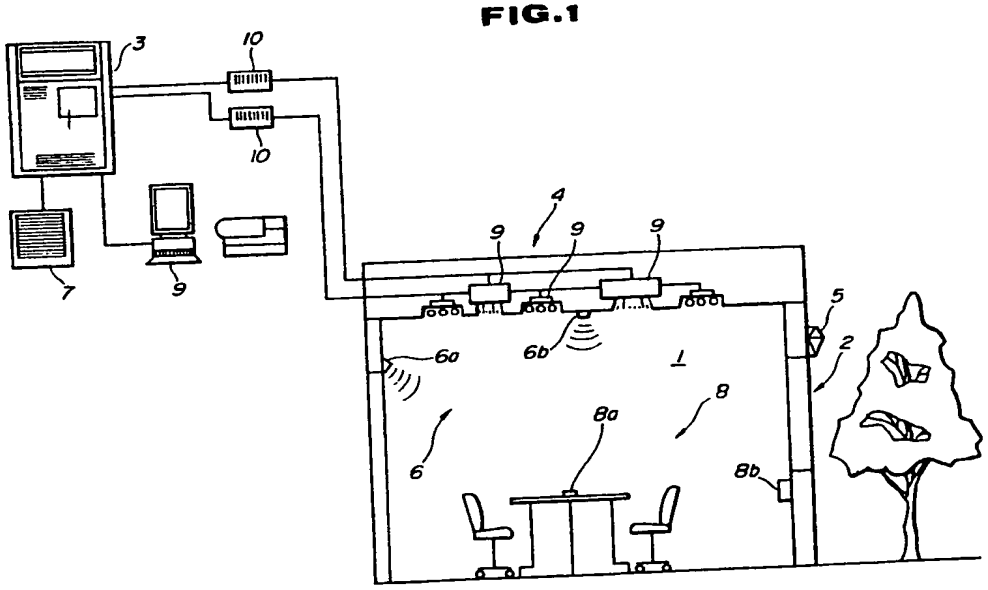

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FIG.1

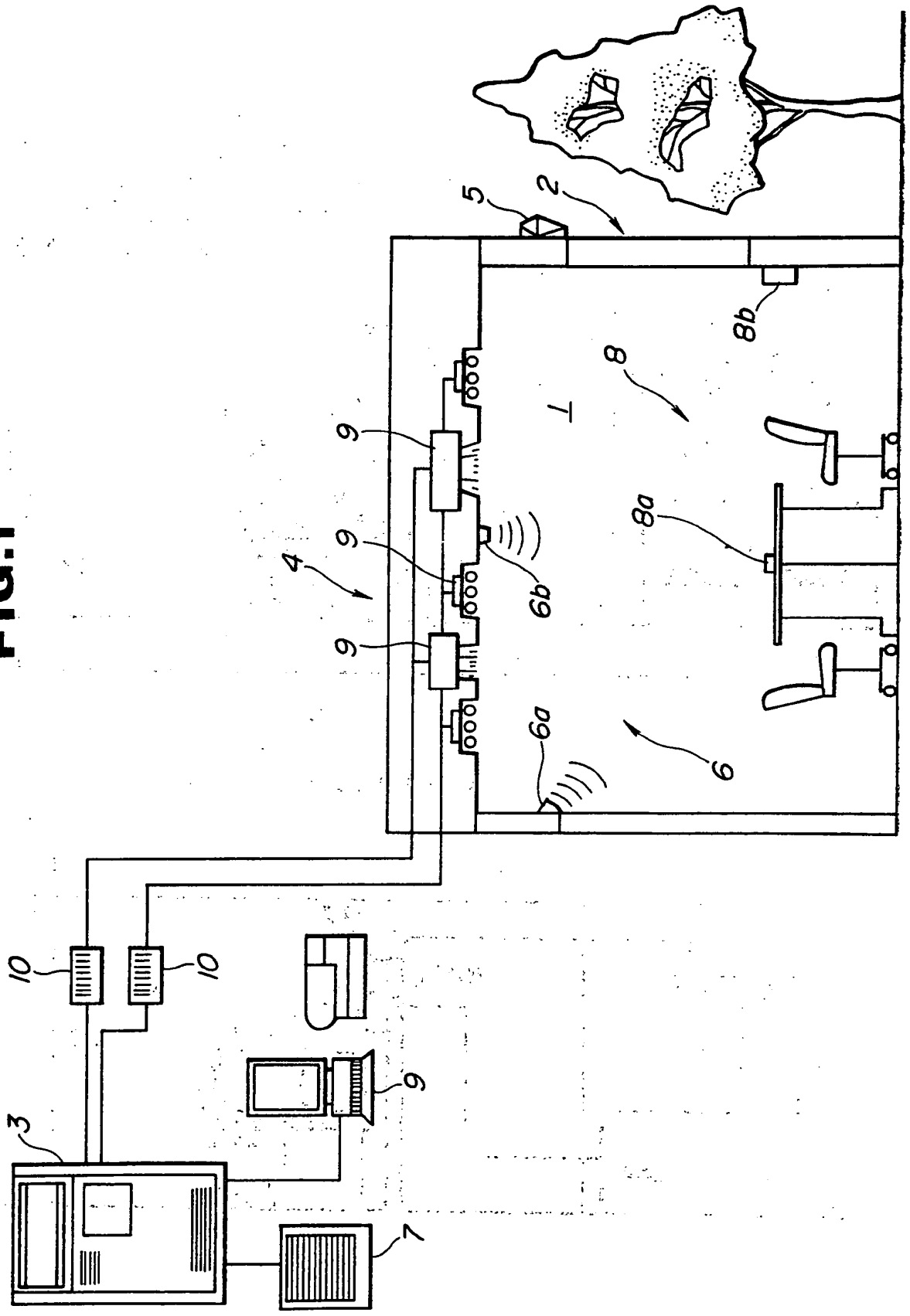


FIG.2

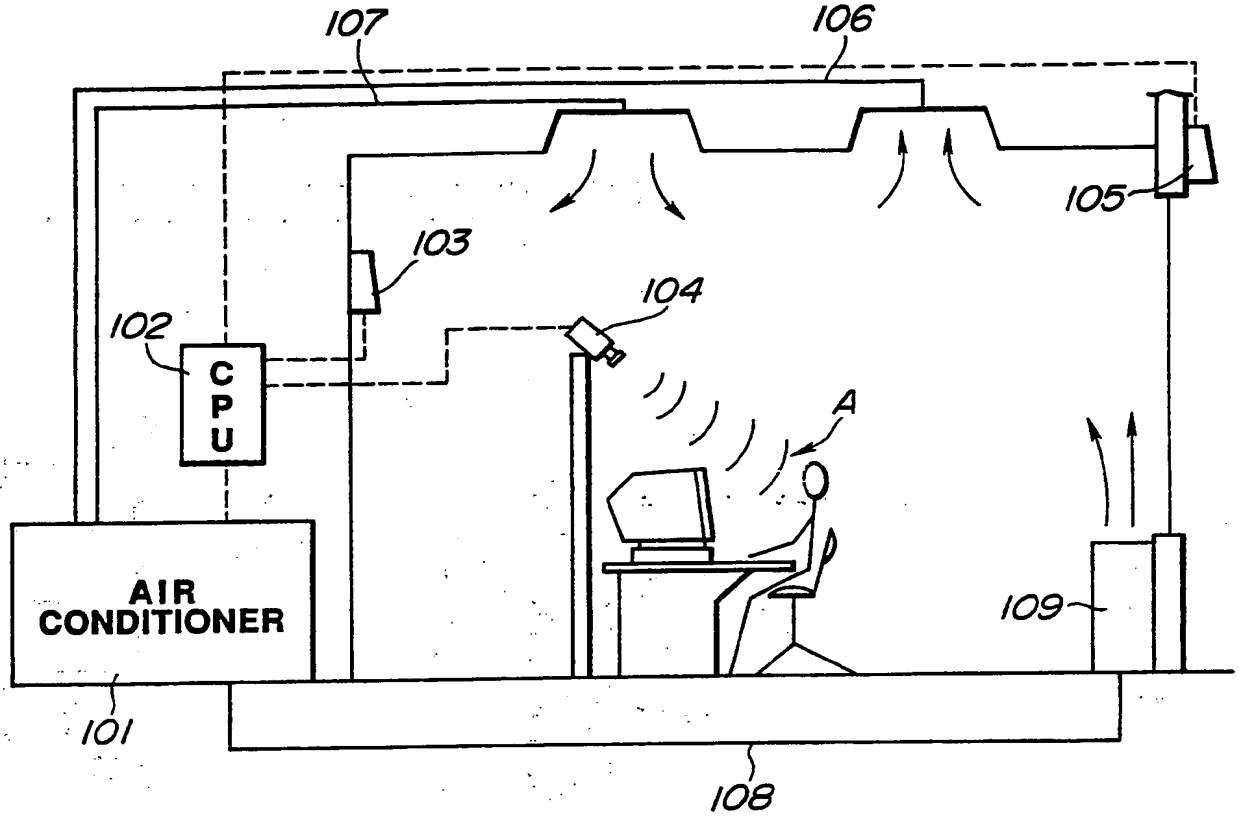


FIG.3

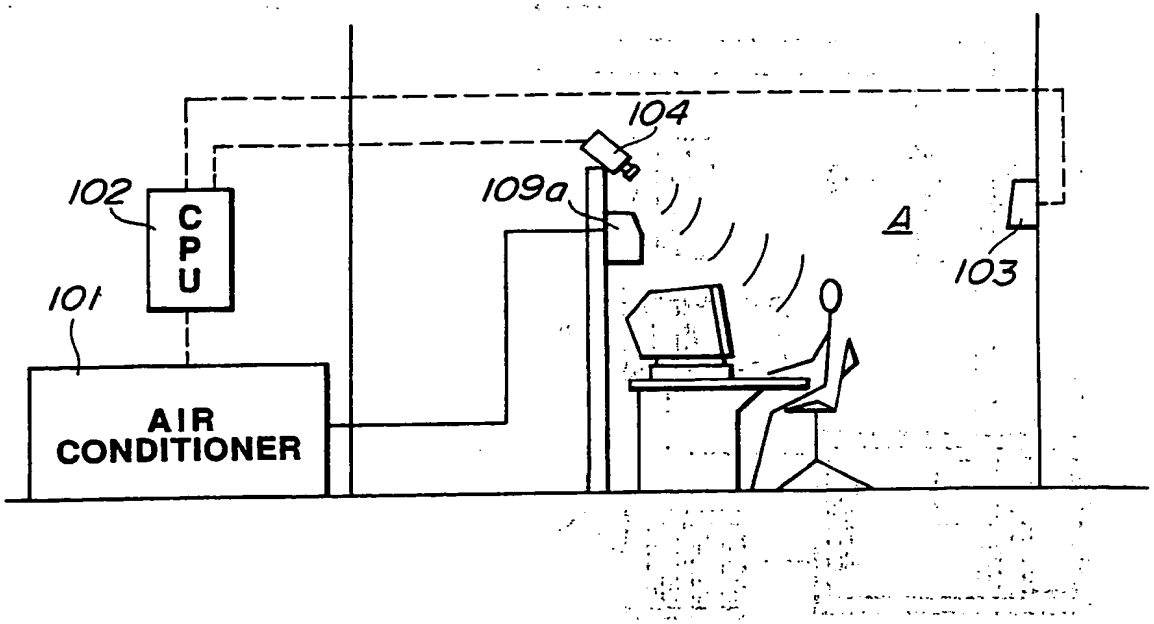


FIG. 4

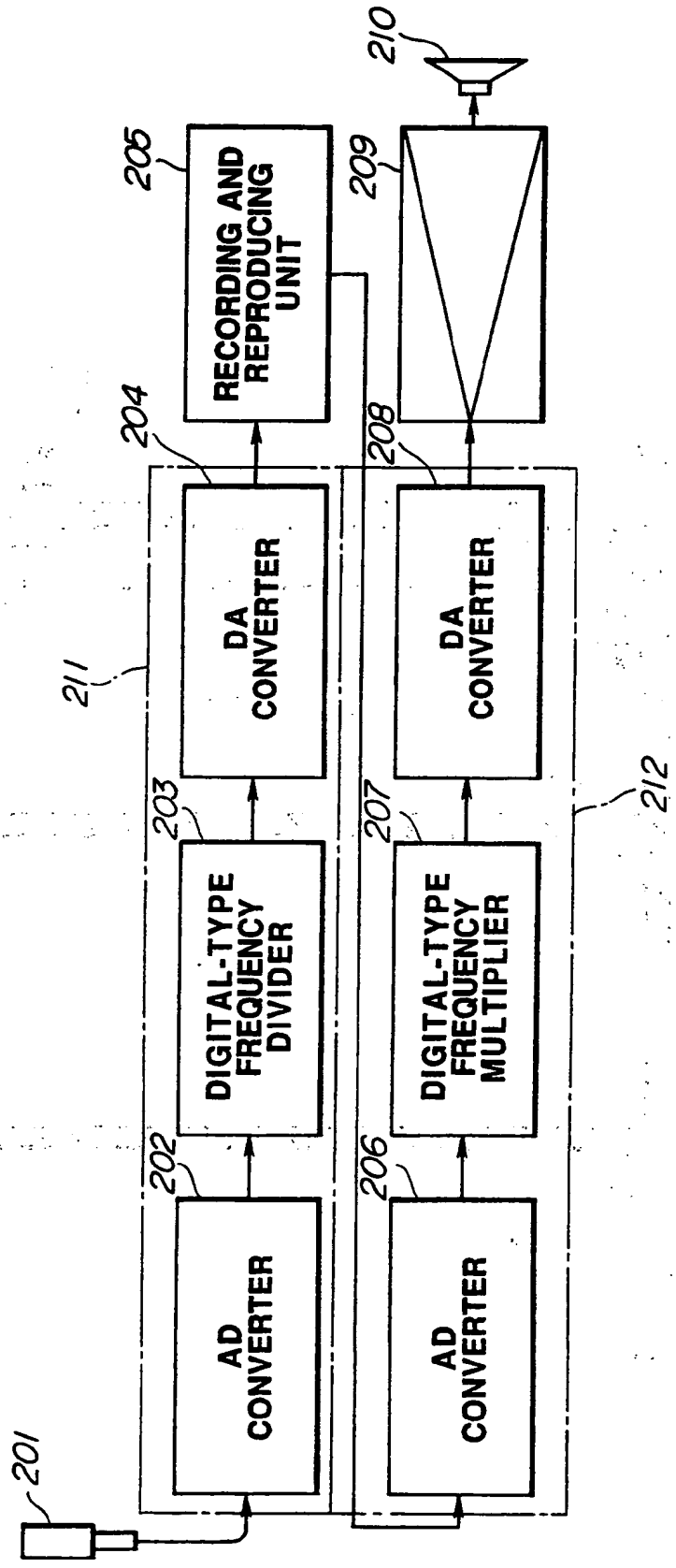


FIG. 5

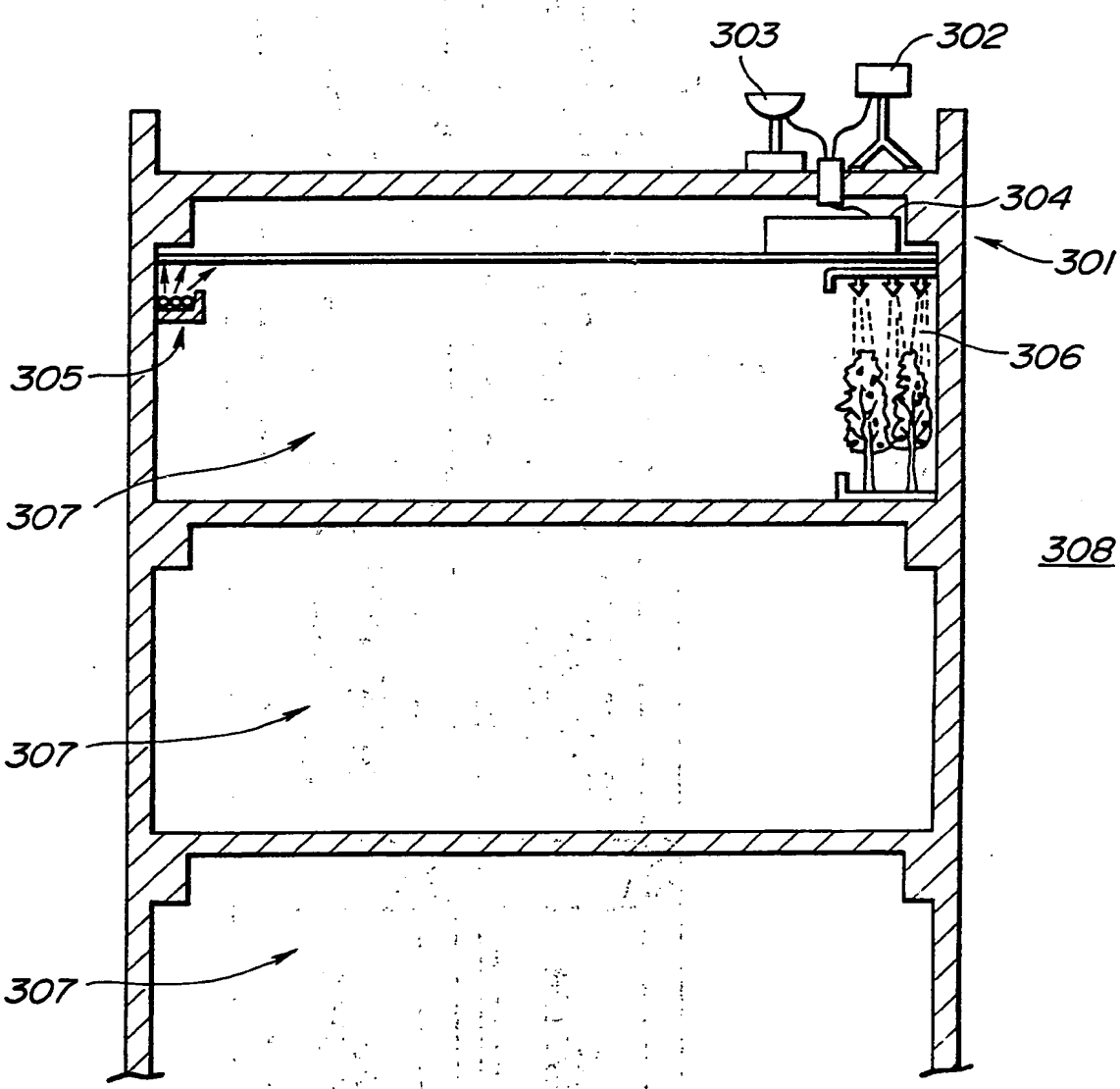


FIG.6

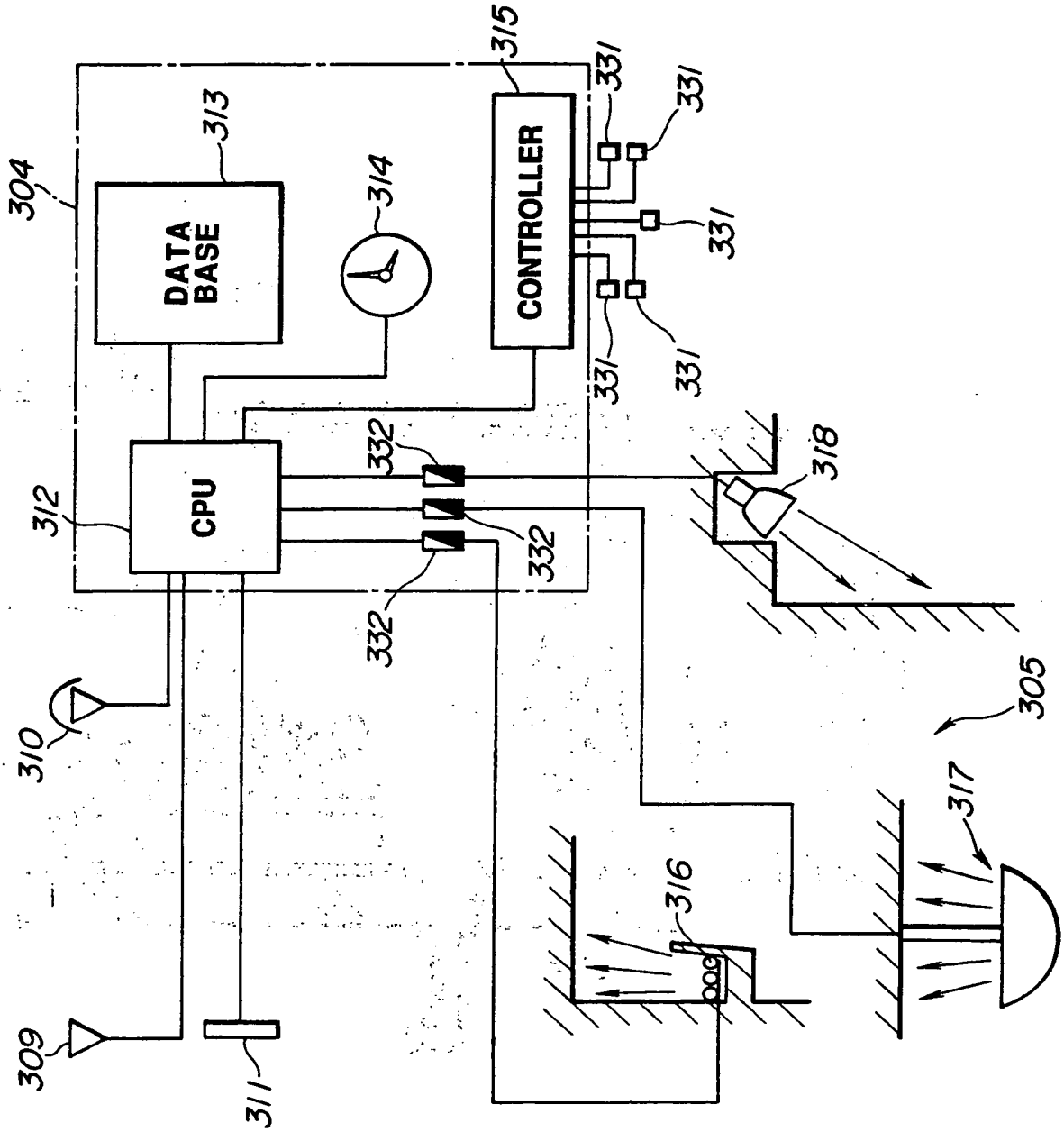


FIG.7

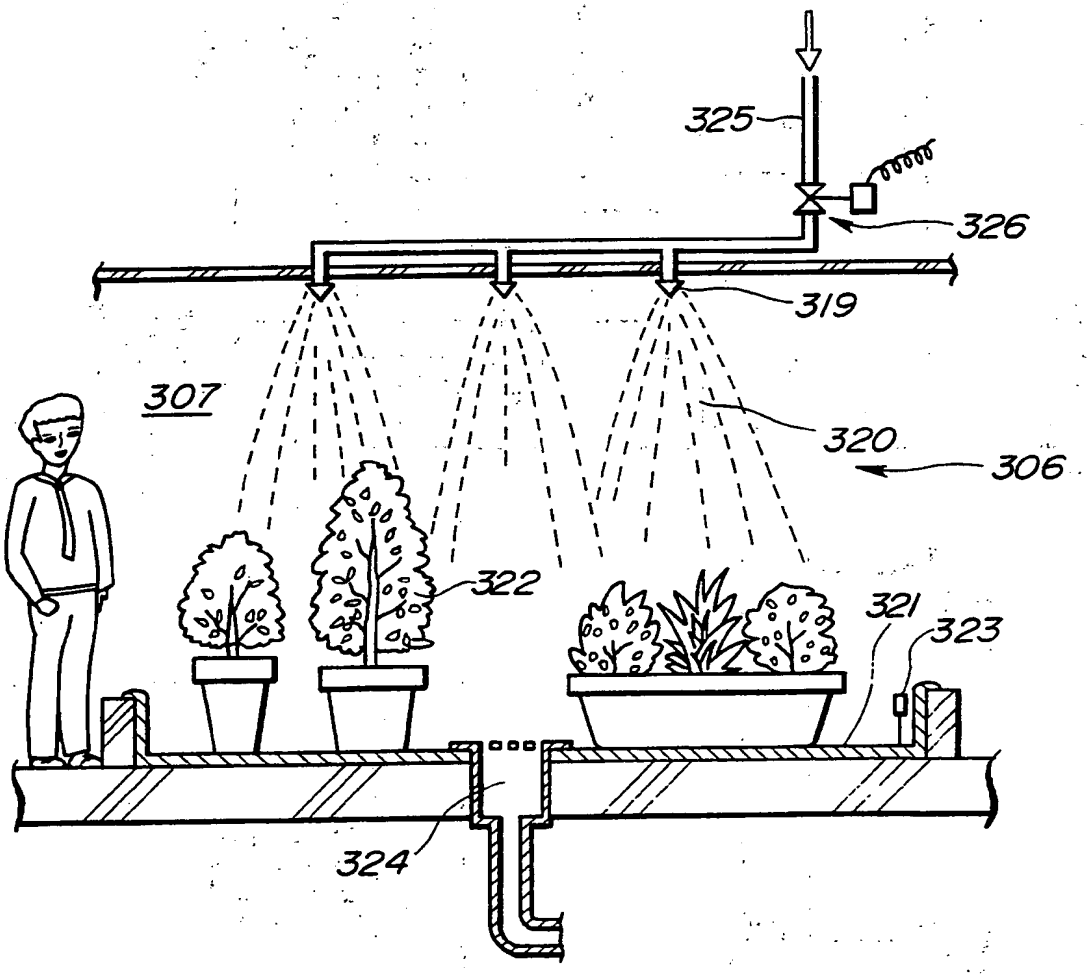


FIG.8

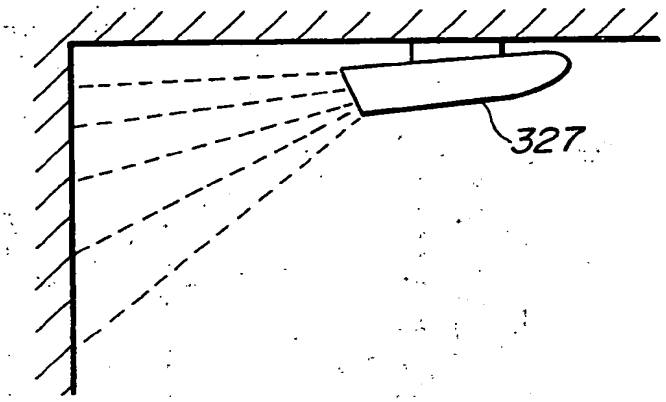


FIG.9

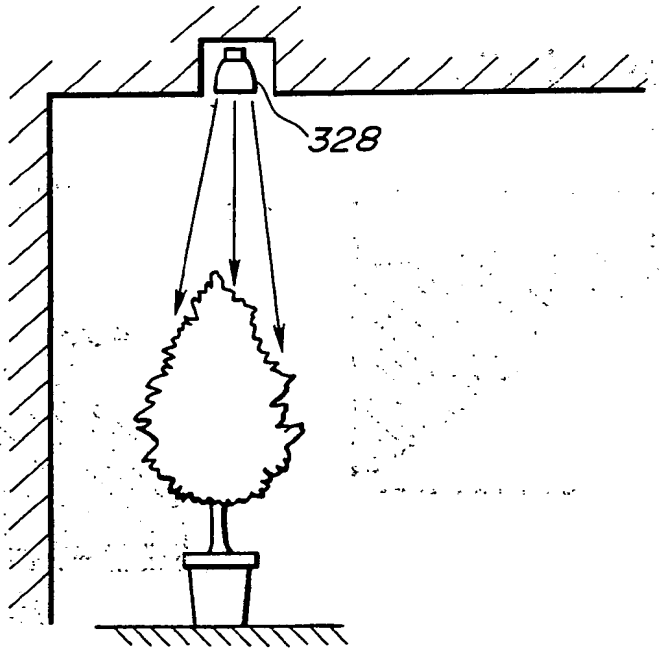


FIG.10

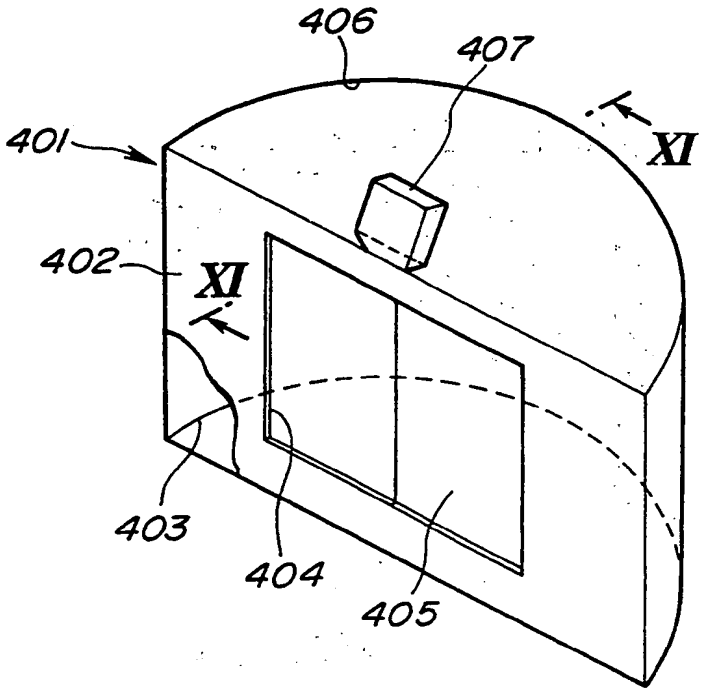


FIG.11

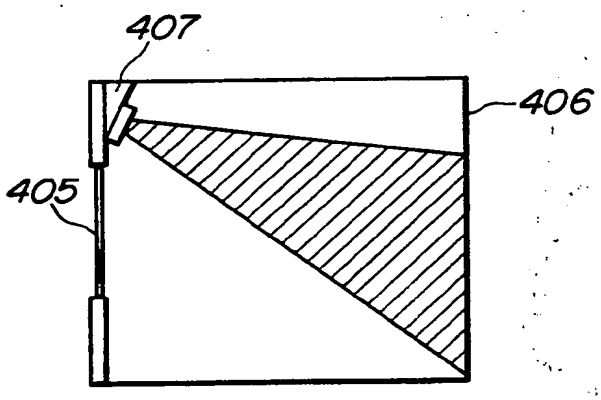


FIG.12

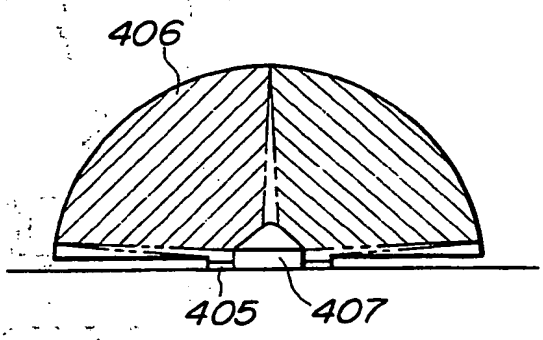


FIG.13

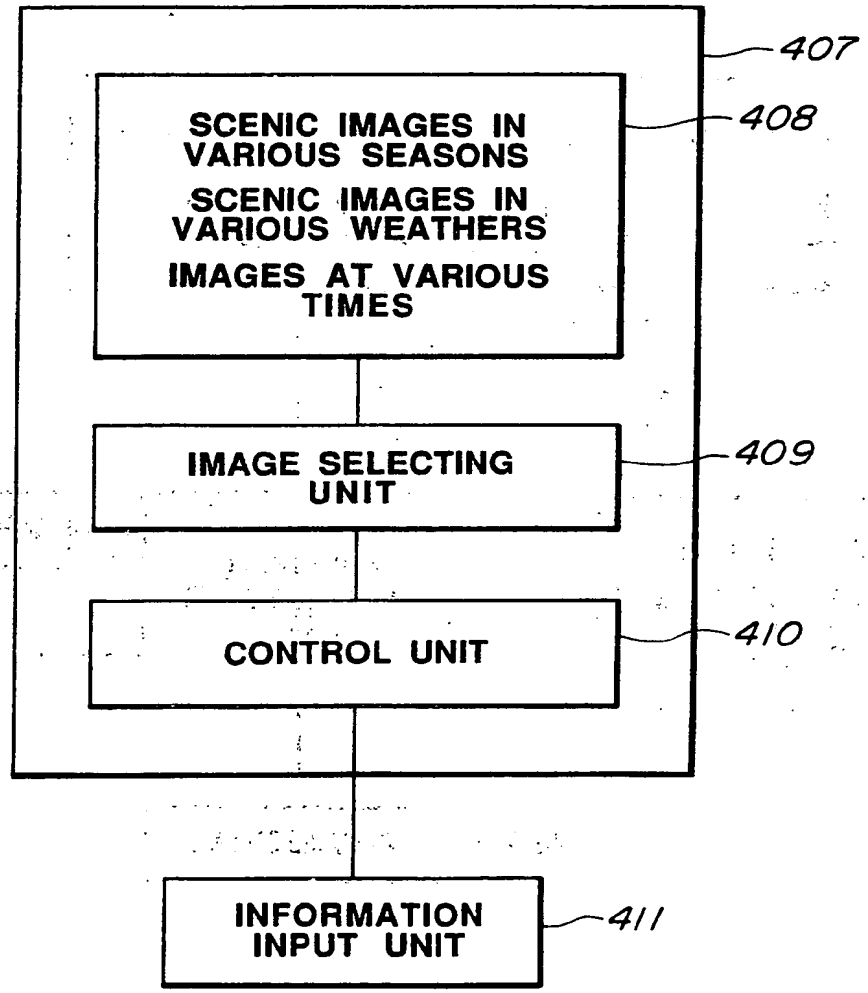


FIG.14

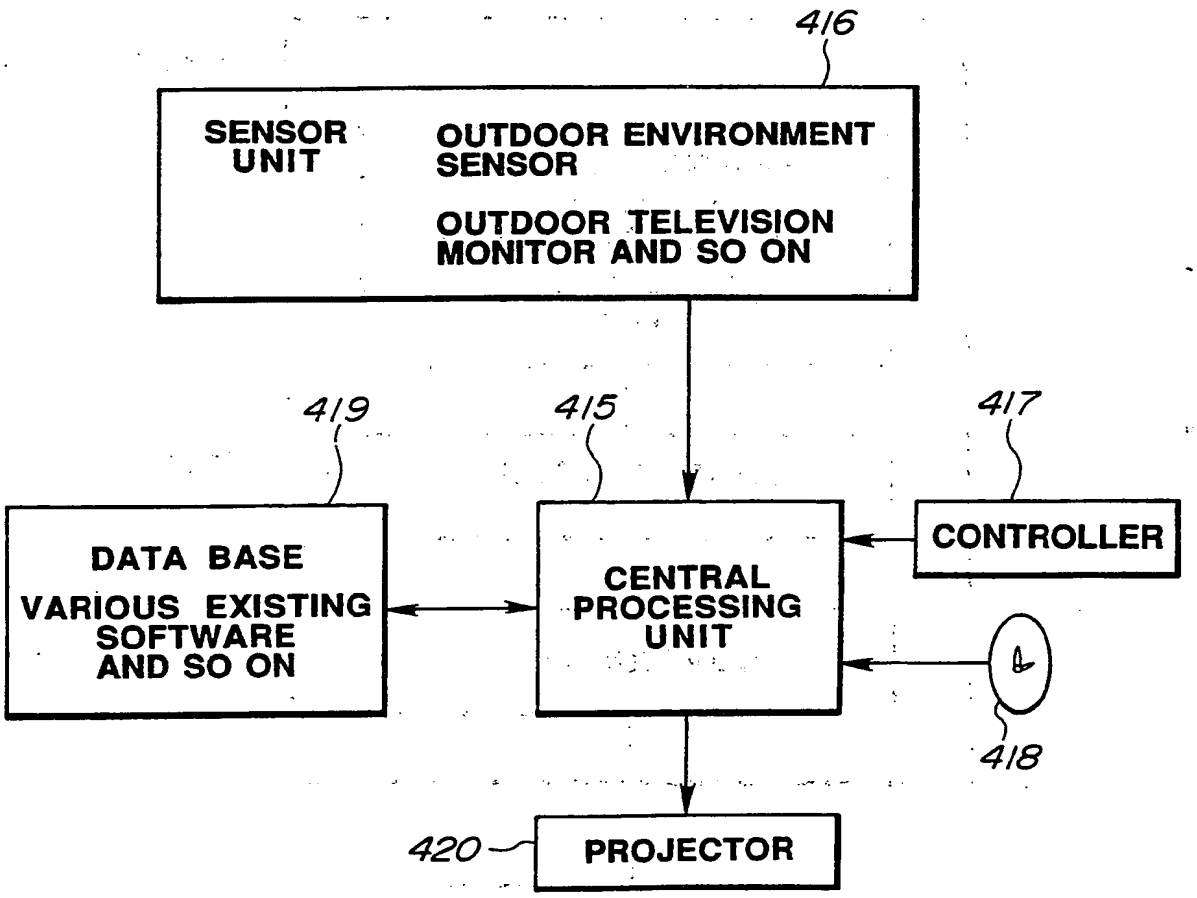


FIG.15

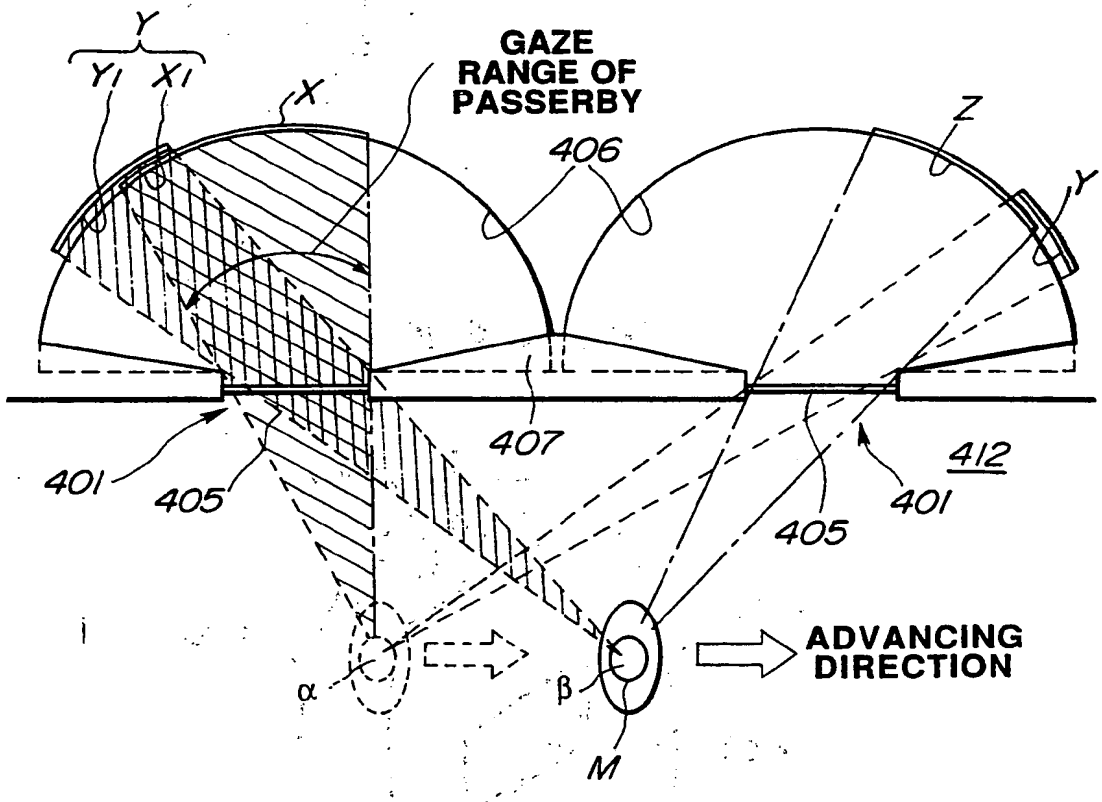


FIG.16

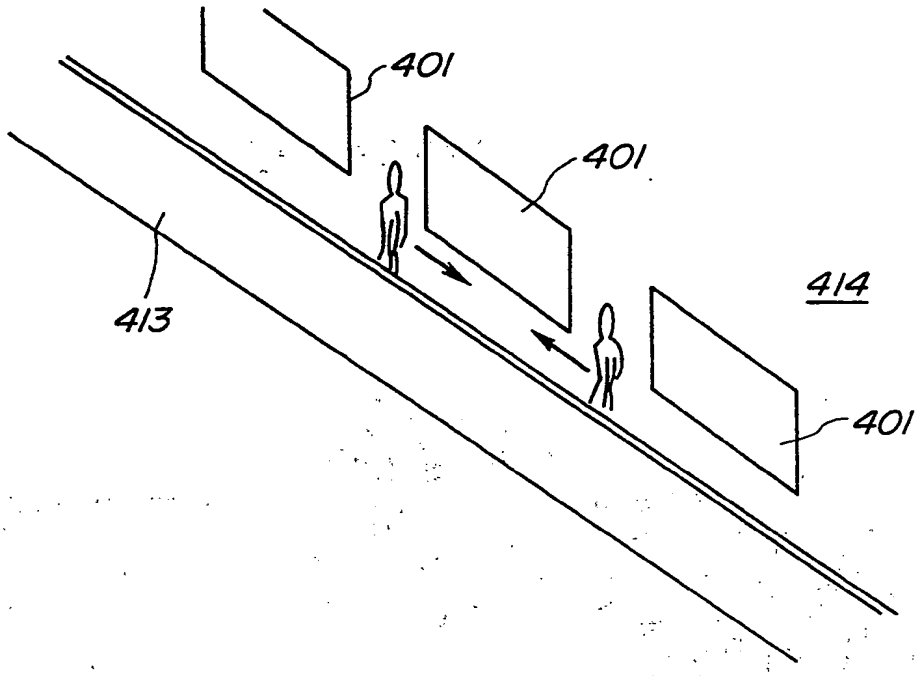


FIG.17

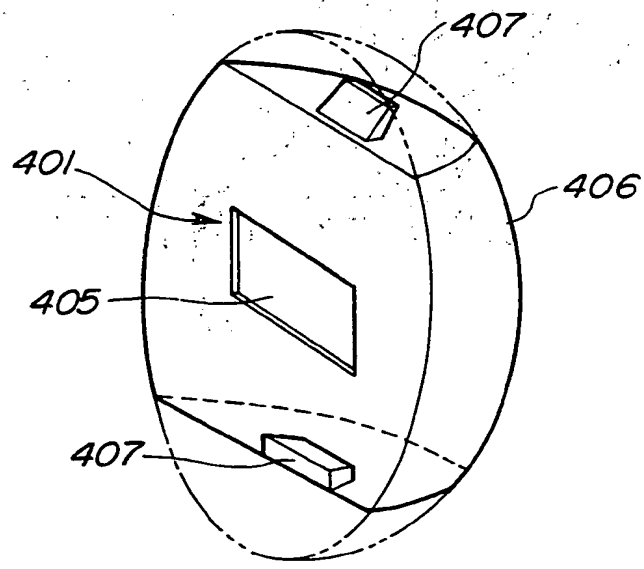


FIG. 18

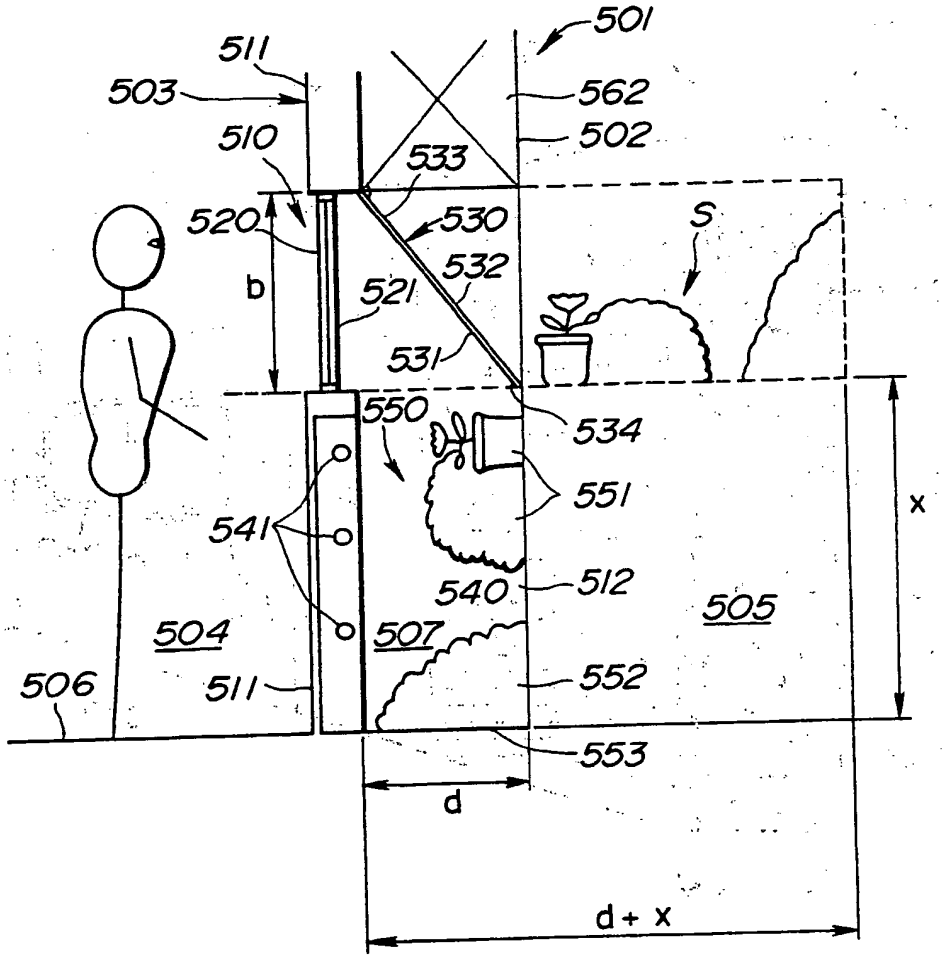


FIG.19

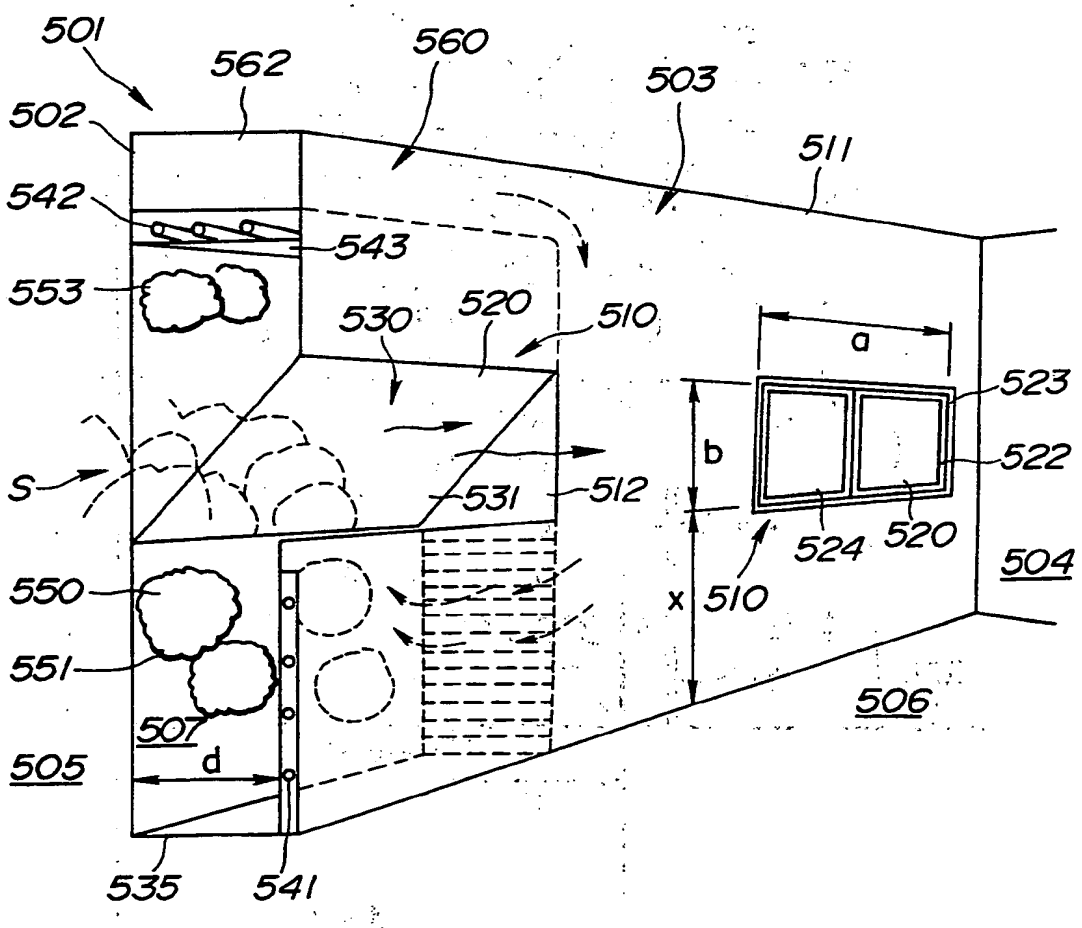
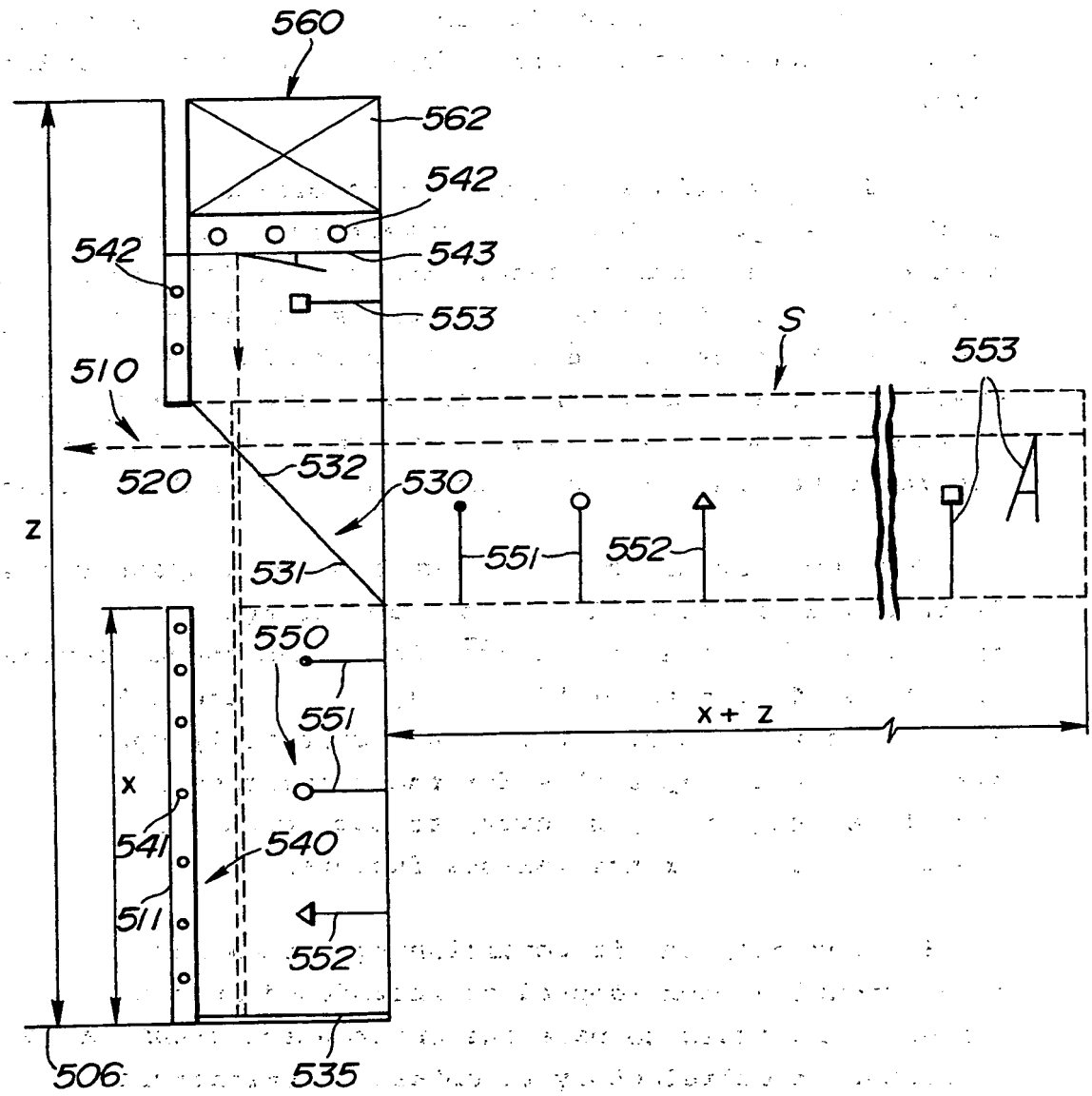


FIG.20



M&C FOLIO: 230P61911 WANGDOC: 0433D

SYSTEM FOR CREATING COMFORTABLE SPACE

The present invention relates to a system for creating a comfortable space in which persons are active, such as an internal space within a building, a space within a vehicle, a space within a vessel or a ship, a space within an airplane, a universal or cosmos space, a space within a large depth underground, or the like.

It is conventionally practise to create a comfortable space. However, conventional methods control various environmental elements or factors in an independent or single manner, such as temperature, humidity, luminosity, luminous flux density, a sound, smell or aroma, and so on. Further, almost all of the control systems have been so arranged as to maintain environmental factors at their respective uniform values.

However, the environment required for a space varies depending upon use of the space, environmental conditions or state on the outside of the space, active condition of persons within the space, or the like. Various environmental factors act compositely upon persons. It is impossible for the conventional technique and method, however, to cope with the composite action of the various factors.

Furthermore, an air conditioning system has conventionally been adopted or introduced into a building, in order to make the environment within a room excellent or satisfactory to obtain a comfortable resident space.

As one of various air conditioning systems for a space within a room, there is control of temperature of the space. Conventional control of the indoor temperature has been arranged such that the temperature is detected by a temperature sensor mounted on a suitable location such as, for example, a wall, and an air conditioner mounted on a building is controlled on the basis of an output signal from the temperature sensor.

There are many cases where the temperature sensor for detecting the indoor temperature is mounted in a location where the temperature sensor is out of the way of harm. In these cases, the temperature sensor detects space temperature in the vicinity of a location where the temperature sensor is mounted. For this reason, the temperature of a location where persons actually are within the room is not directly detected, so that the air conditioner is not controlled on the basis of the temperature of the important location. Thus, the indoor temperature is not necessarily controlled in an optimum manner.

On the other hand, temperatures, which the persons within the room feel, vary according to the individual. Accordingly, conventional uniform control of the room temperature on the basis of the temperature in the vicinity, where the temperature sensor is mounted, makes it impossible for the persons existing within the room to obtain a comfortable indoor temperature.

Thus, it cannot necessarily be said that the optimum indoor temperature for the persons existing within the room is best controlled by the conventional indoor temperature control.

Moreover, methods have conventionally been taken as

follows. That is, in a factory or the like, background music is emitted from a loudspeaker to enhance mental or spiritual conditions or states of workers, thereby increasing the working efficiency. Alternatively, music is played to aid medical treatment or remedy a mental disease.

Any of the above conventional methods rely upon audible sound. In recent years, however, it has been found that, even if an ultrasonic wave equal to or higher than 20 kHz, which is contained, for example, in a natural sound, such as the whisper of leaves or the like, which is not audible, the ultrasonic wave may be effective in medical treatment of modern diseases, such as relaxation of stress, psychosomatic disease, and so on. It has also been found that an ultrasonic wave up to 40 kHz is effective in medical treatment of modern diseases.

The best that a wide use digital type recording and reproducing apparatus can record and reproduce a sound is within a range of from a few Hz to 22 kHz, in relation to a sampling frequency. Accordingly, it is impossible for the apparatus to record and reproduce an ultrasonic wave such as described above. Further, there exists no apparatus to record and reproduce only such an ultrasonic wave.

In modern large buildings, the interior may be completely cut off from the outside and be completely air-conditioned so that the interior is illuminated uniformly and widely from the viewpoint of a plane.

Accordingly, the interior tends to be estranged from variation and condition of the exterior. Particularly, there are many cases where a core section of the building becomes a monotonous or flat space having its

light environment constant and which remains unchanged, regardless of night and day, or persons do not notice the presence of rainfall outside.

For the reasons discussed above, natural rhythm, which is required for the persons, is lacking. Thus, repeated stress, which is particularly unconscious, is a factor of life in such buildings, or the occupants do not notice rainfall until they leave, so that they become inconvenient or uncomfortable. Thus, mental shock is engendered, so that stress is applied to the persons.

Generally, a building is formed with a plurality of windows which communicate with the exterior. The windows have various functions such as a lighting function, a ventilation function, a see-through function, and so on. Since the windows have such functions, normally or usually the windows are provided at their respective locations which are capable of communicating with the exterior.

However, such buildings have a closed space, such as an underground, a core section of a large building and the like, which cannot directly communicate with the exterior. In this closed space, it is impossible to directly lighten the closed space, and to directly take the air into the closed space. Further, since it is impossible for the closed space to see an exterior scene or view, the closed space tends to become a dry or dull space. In this manner, it is impossible for the closed space of the building to provide windows having all of the above-mentioned functions. It is desirable, however, that, in order to allow the persons existing within the closed space to pass or spend days in a comfortable manner as far as possible, the functions, which the windows have as described previously, are

exhibited as far as possible also in the closed space of the building to make the closed space a tasteful space. Further, of the above-mentioned functions, there is the see-through function which the closed space of the building structure has. In view of this, false, suspected or artificial windows are considered as ones which exhibit the see-through function.

The artificial windows may be in the form of a recess in a wall or the like. Window glass material is mounted over the opening of the recess. Appreciation objects are stuck on the wall of the recess at the bottom thereof, or are placed on the lower side wall of the recess, and light thrown upon the objects. By doing so, the objects can be appreciated or enjoyed from the interior through the window glass material. Accordingly, the aforementioned closed space of the building, which tends to become dry or dull, can also become a tasteful space.

In conventional artificial windows, however, the appreciation objects are merely stuck on the wall of the recess at the bottom thereof. Accordingly, there is no sense of distance or perspective. Thus, it is impossible to obtain a scene or spectacle similar to actual windows.

Moreover, in conventional artificial windows, the appreciation objects seen through the glass window are always constant during a predetermined period of time, and do not vary or move. Accordingly, it is impossible to expect "fluctuation". Thus, the artificial objects are far from the natural scene which is seen through the actual window, and it is impossible to obtain the see-through function which the window has originally.

Furthermore, it is conventionally well known that an

opening is not provided in an outer wall of a building, but an artificial window is formed only in an external manner. An example, which is well seen particularly, is such that, in the case where it is impossible to mount a window formed therein with an opening similar to that in a general outer wall surface, to a part of the building, a window frame at least similar to the adjacent window is formed to obtain repeated design ability of the wall surface. Further, there is also an artificial window in which a glass material is fitted into a window frame of the artificial window so that a glance shows that the artificial window has no difference in construction from the actual or general windows except for functions such as a lightening function, ventilation function and so on.

Development in air conditioning equipment in a building reduces the degree of opening and closing of windows. Rather, there increases fixed fitting windows in order to prevent reduction in a/c efficiency by opening and closing of the windows. Further, by development in illumination equipment and the large size of buildings, lighting is not always limited to one due to the natural light, but various means of illumination are used also for a constant or predetermined luminous intensity.

Under the circumstances described above, so-called windowless buildings are frequently used as industrial buildings such as facilities for precision instruments, as buildings for broadcasting industry, or the like. Accordingly, these buildings do not require window sashes to be mounted to the outer wall, and the exterior of the buildings has a design construction which is thorough in function per se.

Further, in a building kept for business which utilises underground rooms, establishment or foundation

of a dry area is restricted by a building site and the cost of construction. Accordingly, a building kept for business cannot but be made a windowless building supplied or covered in equipment, without lighting and ventilation.

One of the various problems of the windowless building is as follows. Even if air conditioning and illumination equipment are perfect or complete, the windowless peripheral wall intercepts or excludes the interior and exterior of the building from each other. As the case may be, the windowless building causes a sense of deadlock and a sense of oppression which are peculiar to a closed space, bringing about a decrease in working efficiency and business effects. Thus, the interior labour environment and the interior residence are deteriorated. Here, however, even if the conventional artificial window is adopted or used, the artificial window is indeed like a plain plate in the interior in which gaze or eyes exist nearby, differentiated from solution in the exterior and design of the building. Thus, it is not absolutely expected to have the effects of the artificial window. After all, the interior illumination, ventilation and so on of the windowless building rely only upon artificial equipments. It is the existing state that the necessity of the artificial window is not rather recognised.

It is therefore an object of the invention to provide a system for creating a comfortable space, which controls various environment factors in a synthetic or collective manner, not in an independent manner, to enable a comfortable space to be created.

It is another object of the invention to provide a system for creating a comfortable space, which can obtain the optimum temperature for persons existing

within a room.

It is still another object of the invention to provide a system for creating a comfortable space, which utilises, as it is, a digital type recording and reproducing apparatus able to record and reproduce, without occurrence of strain at an excellent SN ratio (signal-to-noise ratio), in which a natural sound within a range of from several tens of kHz to 40 kHz is recorded and reproduced.

It is another object of the invention to provide a system for creating a comfortable space, which is able to detect external light and colour and to reproduce the light and the colour into the interior, and which is capable of detecting a rainfall condition to practice simulation production.

It is another object of the invention to provide a system for creating a comfortable space, which is capable of simulating a scene similar to a scene through an actual window.

It is still another object of the invention to provide a system for creating a comfortable space, which is capable of producing "fluctuation" to obtain an image as close to a natural scene as possible.

It is another object of the invention to provide a system for creating a comfortable space, which again serves the function of a window in a windowless building from the viewpoint of its essential condition to provide a rational artificial window.

According to the invention, there is provided a system for creating a comfortable space, comprising:

environment extracting means for extracting, as

input information, at least two environmental factors within a space, which include a factor representing a man's activity;

environment computing means for determining an optimum combination of the environmental factors on the basis of the information obtained by the environment extracting means; and

environment control means for outputting a new environmental factor to the space on the basis of control information from the environment computing means.

In an alternative aspect, there is provided an environment control system for a living space, comprising means to measure at least two environmental factors in the space relevant to the human condition, means to determine the optimum combination of the factors based on the measured values, and means to optimise the factors accordingly.

By 'relevant to the human condition' is meant any aspect of an environmental factor which, if modified, is capable of altering the perceived and/or actual environment.

It will be appreciated that 'optimum' will be according to the individual design of the system, and the 'optimum' values may be any that are deemed suitable.

Preferably, the environment extracting means extracts a plurality of environmental factors on the outside and inside of the space.

With the above arrangement of the invention, the input information extracted from the indoor and outdoor environment factors by the environment extracting means is sent to the environment computing means where the input information is computed and processed to determine

the optimum combination of the environmental factors of the space. The control information is sent to the environment control means from which the new environmental factor is outputted to the space.

Thus, various environmental factors acting upon a person in a composite manner such as temperature, humidity, sound, illumination, aroma and so on are controlled in a synthetic or collective manner, not independently, so that it is possible to create a space highly comforted. A highly comfortable living space can thereby be generated. The active space may be an internal space within a building, a space within a vehicle, a space within a vessel or a ship, a space within an airplane, a universal or cosmos space, a space within a large depth underground, or the like.

Preferably, the environment control means includes air conditioning means for adjusting indoor temperature within the space. The environment extracting means will include an indoor temperature sensor mounted at a predetermined location within the space, for detecting the indoor temperature within the space, and a body-surface temperature sensor for detecting temperature of a body surface of a man existing within the space. The environment control means further includes a control unit for controlling the air conditioning means on the basis of the indoor temperature from the indoor temperature sensor and the temperature of the body surface from the body-surface temperature sensor such that the indoor temperature is brought to a predetermined value.

With the above arrangement of the invention, the air conditioning means is controlled on the basis of the indoor temperature and the temperature of the body surface of the man existing within the space. That is,

the indoor temperature is controlled on the basis of the indoor temperature and the temperature of the body surface of the man. Accordingly, the indoor temperature is controlled in an optimum manner for the man existing within the space.

With the arrangement of the invention, the indoor temperature may be controlled on the basis of the temperature of the body surface and the indoor temperature. Accordingly, the indoor temperature is not merely controlled on the basis of only the indoor temperature unlike the conventional one, but the indoor temperature can be controlled so as to be brought to one most optimum for persons existing within the space. Thus, it is possible to efficiently control the indoor temperature.

Preferably, the environment extracting means further comprises an outdoor temperature sensor for detecting outdoor temperature on the outside of the space. The control unit controls the air conditioning means on the basis of a temperature difference between the outdoor temperature from the outdoor temperature sensor and the indoor temperature from the indoor temperature sensor.

With the above arrangement of the invention, the air conditioning means is controlled also on the basis of the temperature difference between the outdoor temperature and the indoor temperature. Accordingly, the indoor temperature is controlled on the basis of the indoor temperature, the temperature difference between the outdoor temperature and the indoor temperature and the temperature of the body surface. Thus, the indoor temperature is controlled further effectively for the man existing within the room.

Preferably, the air conditioning means conditions

only a specific area within the space. With the above arrangement of the invention, the air conditioning means air-conditions only the specific area within the space. Thus, the indoor temperature is controlled effectively.

Preferably, the comfortable space creating means further comprises stress relaxing means due to a high-frequency natural sound. The stress relaxing means includes a microphone for absorbing the natural sound within a range of from several tens of kHz to 40 kHz, to issue an output signal, an AD converter into which the output signal from the microphone is inputted, a digital type frequency divider for reducing frequency of an output signal from the AD converter by one octave, a recording medium for recording and reproducing an output signal from the digital type frequency divider in one of an analogue manner and a digital manner, a digital type frequency multiplier for multiplying a readout signal from the recording medium by one octave, a DA converter into which an output signal from the digital type frequency multiplier is inputted, and an electric sound converter for emitting an output signal from the DA converter as the natural sound having its frequency within the range of from several tens of kHz to 40 kHz.

With the above arrangement of the invention, the microphone collects the natural sound within the range of from several tens of kHz to 40 kHz. The natural sound is converted into the digital signal. Subsequently, the natural sound is reduced one octave by the digital type frequency divider and is recorded onto the recording medium. The recorded natural sound is reproduced, and is multiplied by one octave by the digital type frequency multiplier. The natural sound is converted into the analogue signal. Subsequently, the natural sound is emitted from the electric sound converter as the natural sound within the range of from

several tens of kHz to 40 kHz.

Specifically, with the above arrangement of the invention, the following superior advantages can be obtained. That is, it is possible to reproduce the high-frequency natural sound having its frequency within the range of from several tens of kHz to 40 kHz to use the high-frequency natural sound as stress relaxation. Further, since the frequency divider and the frequency multiplier are those of digital type, only reduction of the high-frequency natural-sound input signal by one octave enables the high-frequency natural-sound input signal to be recorded onto the recording medium as an audible sound signal. Moreover, only multiplication by one octave enables the high-frequency natural-sound input signal to be easily converted to the high-frequency natural sound for stress relaxation.

Preferably, the environment control means further comprises simulation means for simulating an outdoor natural environment into the space on the basis of the information from the environment extracting means.

With the above arrangement of the invention, within the interior, environment varies depending upon the outdoor conditions. Thus, the interior is not formed into a space which is uniform and monotonous, but is formed into a fluctuate space which varies depending upon time. The fluctuate space comfortably stimulates sense and sensitivity of a man so that the man is refreshed and relaxed. Thus, stress can be dissolved. This means an improvement in business effects and production efficiency.

Preferably, the environment extracting means detects an outdoor rainfall condition. The simulation means simulates the outdoor natural environment into the space

on the basis of an output signal from the environment extracting means.

With the above arrangement of the invention, in addition to the fact that the above-described advantages are produced by establishment of the environment extracting means which detects the outdoor rainfall condition, one can know presence of the outdoor rainfall. Accordingly, there is also produced such an advantage that trouble such as again returning to the space from the entrance at going out can be dispensed with.

Preferably, the comfortable space creating means further includes at least one artificial window which comprises a recess provided in a wall of the space, the recess having an opening, a curved surface screen formed in a bottom wall of the recess in a curved surface manner, an image machine for projecting an image onto the curved surface screen, and a window glass material mounted to the opening of the recess.

With the above arrangement of the invention, the image is projected onto the curved surface screen having its depth. Accordingly, when the artificial window is seen from any direction, it is possible to obtain the image which has the sense of distance and the sense of three dimensions. Thus, it is possible to enjoy scenery which is closer to natural in the artificial window.

Preferably, the comfortable space creating means includes a plurality of artificial windows arranged in side by side relation to each other.

With the above arrangement of the invention, if the plurality of artificial windows are provided in a continuous manner and if the image projected is suitably

continuous, it is possible to form a large range or large panoramic image in the artificial windows. Accordingly, it is possible for scenery through the artificial windows to approach the actual scenery of the windows. Moreover, the projected image varies depending upon the actual outdoor scenic condition, whereby it is possible for the scenery through the artificial windows to further approach the actual window scenery.

Preferably, the image, which is projected upon the curved surface screen, is an animation.

With the above arrangement of the invention, if the image projected on the curved surface screen is a dynamic image or animation, it is possible to produce "fluctuation". Accordingly, the scenery through the artificial window can further approach actual window scenery, so that it is possible to enjoy natural scenery through the artificial window.

Preferably, the comfortable space creating system further includes an artificial window forming a window without provision of an opening in a windowless wall of the space, the artificial window comprising an auxiliary wall provided on an inner surface of the windowless wall with spacing defined between the inner surface and an outer surface of the windowless wall, an opening formed in the auxiliary wall, a reflecting mirror unit arranged within the spacing and inclined outwardly such that a front face of the reflecting mirror unit faces toward the opening, and an illumination equipment arranged within the spacing in facing relation to the front face of the reflecting mirror unit.

With the above arrangement of the invention, that is, by using a reflecting mirror unit, it is possible to create a horizontal extent equal to or larger than the

depth of the artificial window, it is possible to form existence of the window having verisimilitude and, simultaneously, it is possible to unconsciously obtain an open feeling from a closed space. Further, labour environment within the windowless building and residence are considerably improved, and the comfortable space creating system is effective as an artificial window which is required for the windowless building. Moreover, the auxiliary wall is necessary for the basic construction of the artificial window. However, not only a double wall in the underground room has its usual or ordinary construction, but also the space behind the double wall accommodates the window having its depth, the reflecting mirror unit and the illumination equipment so that the space is provided as a duct space of an air conditioning equipment. Thus, there is almost no affect or influence on the cost of construction. Furthermore, since the space is formed by the auxiliary wall, maintenance means is secured for a permanent equipment of the reflecting mirror unit and the illumination equipment. Thus, remodelling, replacement and so on are made easy. The degree of freedom such as avoidance of fixing of the outdoor scenery and so on is large. There is obtained such an advantage that a value added is large as a whole.

The invention will now be further illustrated with reference to the accompanying drawings, in which:

Fig. 1 is a constitutional view showing a first embodiment of a comfortable-space creating system according to the invention;

Fig. 2 is a view showing a second embodiment of the comfortable-space creating system according to the invention;

Fig. 3 is a view showing a modification of the second embodiment illustrated in Fig. 2;

Fig. 4 is a block diagram showing a third embodiment of the invention;

Fig. 5 is a schematic view showing a fourth embodiment of the invention;

Fig. 6 is a view for explanation of a light-adjusting producing apparatus in the comfortable-space creating system illustrated in Fig. 5;

Fig. 7 is a view for explanation of a suspected rainfall apparatus of the comfortable-space creating system illustrated in Figs. 5 and 6;

Fig. 8 is a view showing a first modification of the fourth embodiment illustrated in Figs. 5 through 7;

Fig. 9 is a view similar to Fig. 8, but showing a second modification of the fourth embodiment illustrated in

Figs. 5 through 7;

Fig. 10 is a perspective view showing an fifth embodiment of the invention;

Fig. 11 is a cross-sectional view taken along the line XI - XI in Fig. 10;

Fig. 12 is a top plan view of the fifth embodiment illustrated in Figs. 10 and 11;

Fig. 13 is a schematic constitutional view of an image machine in the comfortable-space creating system illustrated in Figs. 10 through 12;

Fig. 14 is a schematic constitutional view of a suspected-window reflection selecting apparatus of the comfortable-space creating system illustrated in Figs. 10 through 13;

Fig. 15 is a top plan view of a first modification of the fifth embodiment illustrated in Figs. 10 through 14;

Fig. 16 is a view for explanation of a use example of the comfortable-space creating system illustrated in Figs. 10 through 15;

Fig. 17 is a view showing a second modification of the fifth embodiment illustrated in Figs. 10 through 14;

Fig. 18 is a vertical cross-sectional view of a suspected window of the comfortable-space creating system according to a sixth embodiment of the invention;

Fig. 19 is a perspective view of the inner side of the suspected window illustrated in Fig. 18; and

Fig. 20 is a cross-sectional view for explanation of function and advantages of the suspected window illustrated in Figs. 18 and 19.

Referring first to Fig. 1, there is shown, in a schematic manner, a comfortable-space creating system according to a first embodiment of the invention.

The comfortable-space creating system comprises an environment extracting apparatus 2 for extracting, as input information, a plurality of environment factors on the inside

and outside of a space or building space 1, an environment arithmetic or computing apparatus 3 for determining a combination of the environment factors optimum for the space 1 on the basis of the information obtained by the environment extracting apparatus 2, and an environment control apparatus 4 for outputting a new factor to the space 1 on the basis of the control information from the environment computing apparatus 3.

The environment extracting apparatus 2 comprises an outdoor-environment extracting unit 5 for extracting outdoor environment of the space 1, a man's-activity extracting unit 6 for detecting an active condition of a man within the space 1, a space-factor data base 7 given beforehand in agreement with a use of the space 1, and an indoor-environment sensor unit 8 for detecting environmental conditions within the space 1. The man's-activity extracting unit 6 includes a plurality of extracting elements 6a and 6b, while the indoor-environment sensor unit 8 includes a plurality of environment sensors 8a and 8b.

The outdoor-environment extracting unit 5 is provided in view of the fact that the environment conditions of the space 1, within which the man is active, are required to be determined closer to the outdoor environment, and natural fluctuation is an important factor for comfortableness. The outdoor-environment extracting unit 5 is arranged such that outdoor temperature, humidity, radiation, wind velocity, wind pressure, brightness or illuminance, luminance and so on are measured by the use of the existing sensor technique, or by a sensor which is so improved as to detect fluctuation, and factors suitable for control of indoor environment are extracted from the measurement results of the sensor.

The man's-activity extracting unit 6 detects the man's activity within the space 1, to send the detecting data to the environment computing apparatus 3. Methods of detecting the man's activity include photographing by means of a television camera to practice picture analysis,

measurement of an amount of radiation in agreement of a range with radiation from a man's skin, provision of a sensor, radar or the like for detecting man's activity, at an interior of a room or the entrance thereof, carrying of a transmitter serving also as an ID card with persons who are active within the room to see movement of the persons, selective detection of only a talking voice of the persons from a sound to measure an amount of conversation, and so on.

The space-factor data base 7 is constructed as follows. That is, in view of the fact that, as factors surrounding environment of the space 1, there are factors which vary from hour to hour like the outdoor-environment extracting unit 5 and the man's-activity extracting unit 6, and factors given beforehand in agreement with a use of the space 1. Regarding these factors or conditions, a data base is prepared, and input information required for control of the environment is obtained from the data base. As the information stored within the data base, it is possible to cite a use of the space, that is, schedule of a use for a multiple-purpose space, conditions of location, a season, organization of an intended group of persons, and so on. The organization of the intended group of persons includes the distinction of sex and age.

The indoor-environment sensor unit 8 detects the environmental conditions within the space 1, which include temperature, humidity, radiation, illuminance, a sound level, aroma and so on. The indoor-environment sensor unit 8 is so improved as to detect fluctuation by reduction of time constant on the basis of the existing sensor technique. Further, it is desirable that a plurality of sensors are mounted within the space 1 to measure distribution within the space 1.

On the other hand, the environment computing apparatus 3 determines an optimum combination of the various environment factors, on the basis of the information obtained by the outdoor-environment extracting unit 5, the man's-activity extracting unit 6, the space-factor data base 7 and

the indoor-environment sensor unit 8, to send control information to various environment control instruments 9 and 9 of the environment control apparatus 4. Specifically, there are:

1) Appraisal or estimation of a degree of comfortableness of the space 1 at this point of time on the basis of various information obtained from the indoor-environment sensor unit 8.

2) Similar development of the information from the outdoor-environment extracting unit 5, the man's-activity extracting unit 6 and the space-factor data base 7, to appraise the degree of comfortableness desired for the space 1.

3) Obtaining of an output required for the various environmental factors in order to agree the appraisal value of 1) with the appraisal value of 2).

4) Addition of an amount of fluctuation to the output information sent to the various environmental factors to output the output information to the environment control apparatus 4.

The environment control apparatus 4 is a gathering or assemblage of the various factor-environment control instruments 9 and 9, and is a section which practices output from this system. Accordingly, instruments are used in which abilities such as variation in output and realization of fluctuation are added to the conventional environmental instruments such as air conditioning, illumination and so on.

The operation of the comfortable-space creating system constructed as above will be described below.

As shown in Fig. 1, the outdoor environment is detected by the outdoor-environment extracting unit 5, the indoor environment is detected by the indoor-environment sensor unit 8, and the man's activity is detected by the man's-activity extracting unit 6. The detected results are sent to the environment computing apparatus 3. The environment computing apparatus 3 computes the optimum environment, and outputs and fluctuation values of the respective factor environment sub-systems required for the

optimum environment, on the basis of the above-mentioned variable data and the data of the space-factor data base 7, to send a signal to a pair of factor-environment control units 10 and 10. The factor-environment control units 10 and 10 control the various environment control instruments 9 and 9 equipped with variation in the output and occurrence of fluctuation on the basis of the signal sent from the environment computing apparatus 3. By doing so, various environment factors such as air-conditioning, illumination, aroma or the like are outputted respectively from the various environment control instruments 9 and 9 into the space 1 at the optimum condition.

According to the comfortable-space creating system of the first embodiment, the environmental factors such as temperature, humidity, sound, illumination, aroma and the like are controlled in a synthetic manner, not in an independent manner, to automatically create environment highly comfortable. Further, at control of the environment described previously, the outdoor natural condition at that time, the condition of the man's activity, function of the space that is the subject, a use and the like, in addition to the environment condition within the space 1, are used as the input data, whereby it is possible to create a space more optimum. Furthermore, fluctuation is given to the various environment factors that are the outputs from the system. Thus, a physiological action and a metal action of the main with respect to the environment variation are considered whereby attention can be made to consider a countermeasure which is closer or warmer and which is in more conformity with the reality.

Referring next to Fig. 2, there is shown a comfortable-space creating system according to a second embodiment of the invention. The comfortable-space creating system is so arranged as to control temperature within a room.

The comfortable-space creating system comprises an air conditioner 101, a control unit (CPU) 102 for the air

conditioner 101, an indoor-temperature sensor 103 for detecting indoor temperature, an infrared temperature sensor 104 for detecting temperature of a body surface of a person existing within the room, and a outdoor temperature sensor 105 for detecting outdoor temperature.

In Fig. 2, the air conditioner 101 is connected to a location within the room through a drawing duct 106 whose one end is open to the ceiling. Further, the air conditioner 101 is connected to a location within the room through a blowing duct 107 whose one end is open to the ceiling. The air conditioner 101 is connected to an indoor instrument 109 which is mounted on a floor of the room through a blowing duct 108. Accordingly, the air conditioner 101 is so arranged that air within the room is drawn through the drawing duct 106 and is cleaned, temperature of the air is regulated, and the air is blown from the ceiling and the indoor instrument 109 through the blowing ducts 107 and 108.

The control unit 102 is connected to the air conditioner 101. Connected to the control unit 102 are the indoor temperature sensor 103 mounted to a suitable location within the room, for instance, to an upper portion of an inner wall in the illustrated embodiment, the infrared temperature sensor 104 mounted to a location A where persons particularly exist within the room such as a work place, for example, an office-automation corner, a study room, or the like, and the outdoor temperature sensor 105 mounted to a suitable location of the exterior, for example, to an upper portion of an outer wall in the illustrated embodiment.

In the comfortable-space creating system constructed as described above, the indoor temperature detected by the indoor temperature sensor 103, the temperature of the body surface detected by the infrared temperature sensor 104 and the outdoor temperature detected by the outdoor temperature sensor 105 are supplied to the control unit 102. The control unit 102 controls the air conditioner 101 such that the indoor temperature is brought to set comfortable temperature on the basis of the indoor

temperature, the temperature of the body surface and a temperature difference between the indoor temperature and the outdoor temperature.

Fig. 3 shows a modification of the second embodiment illustrated in Fig. 2. In Fig. 3, components and parts like or similar to those illustrated in Fig. 2 are designated by the same or like reference numerals, and the description of the like or similar components and parts will be omitted to avoid repetition.

As shown in Fig. 3, an indoor instrument 109a is mounted to the location A. The indoor instrument 109a air-conditions only a specific area such as the location A within the room. In this case, the indoor temperature sensor 103 is arranged at the location A. In this modification, no outdoor temperature sensor is provided.

In the comfortable-space creating system constructed as described above according to the modification of the second embodiment, the control unit 102 controls the air conditioner 101 on the basis of the temperature at the location A from the indoor temperature sensor 103 and the temperature of the body surface from the infrared temperature sensor 104. In this case, the indoor instrument 109a air-conditions only the location A in a spot manner. By doing so, a location, where air conditioning is not so much required, is not air-conditioned so that there is no waste, and it is possible to air-condition the location A in an efficient manner.

In connection with the above, the invention should not be limited to the above-described second embodiment and the modification thereof, but various modifications and variations can be made to the invention.

For example, in the second embodiment, the outdoor temperature is also considered to control the indoor temperature. However, the outdoor temperature sensor 105 may be omitted at a location where the indoor temperature is not so much effected or influenced by the outdoor temperature. Similarly, the above modification of the second embodiment

has no outdoor temperature sensor. However, the outdoor temperature sensor may be provided so that consideration is made also to the outdoor temperature to control the indoor temperature.

Referring next to Fig. 4, there is shown a comfortable-space creating system according to a third embodiment of the invention. Although not shown, the comfortable-space creating system illustrated in Fig. 4 comprises its constitution similar to that illustrated in Fig. 1, 2 or 3, and further comprises a stress relaxing apparatus whose circuit diagram is illustrated in Fig. 4.

The stress relaxing apparatus comprises a microphone 201 and a sound-recording processing device 211. The sound-recording processing device 211 includes an AD converter 202, a digital-digital-conversion-type frequency divider 203, and an DA converter 204. The microphone 201 is capable of collecting a natural sound within a range of from several tens of KHz, for example, from an audible sound having its frequency of 20 KHz or more contained in a sound occurring due to the whisper of the leaves, to 40 KHz including an ultrasonic wave. The AD converter 202 converts an analog signal from the microphone 201 to a digital signal. The digital-digital-conversion-type frequency divider 203 reduces the signal representing the natural sound within the range of from several tens of KHz to 40 KHz by one octave, that is, divides the natural sound signal to an audible sound signal within a range of from several tens of KHz to 20 KHz, to add, for example, the digital signal to a flip-flop thereby being converted to a half frequency signal, in order to enable the audible sound to be recorded onto a recording and reproducing unit 205 subsequently to be described. The DA converter 204 converts the half frequency signal to an analog signal. The recording and reproducing unit 205 is connected to the DA converter 204. The recording and reproducing unit 205 is provided with a magnetic tape for recording the analog signal outputted from the DA converter 204.

On the other hand, the stress relaxing apparatus further comprises a reproducing-signal processing device 212 which includes an AD converter 206, a digital-digital-conversion-type frequency multiplier 207 and a DA converter 208. The AD converter 206 converts the analog signal read out from the recording and reproducing unit 205, into a digital signal. The digital-digital-conversion-type frequency multiplier 207 divides the input digital signal into, for example, two, in order to multiply the digital signal by one octave, that is, to multiply the digital signal into a natural sound signal within the range of from several tens of KHz to 40 KHz. One of the divided two signals is directly inputted to an OR gate. The other signal is delayed by a delay circuit having such delay time as to obtain multiplied frequency, and is inputted to the OR gate. Thus, the digital-digital-conversion-type frequency multiplier 207 outputs a multiplied-frequency signal. The DA converter 208 converts the multiplied-frequency signal to an analog signal. The DA converter 208 has its output signal which is amplified by an amplifier 209 connected to a loudspeaker 210. The loudspeaker 210 is capable of emitting a natural sound containing the audible sound and the ultrasonic wave within the range of from several tens of KHz to 40 KHz.

The operation of the comfortable-sound creating system according to the third embodiment will be described below with reference to Fig. 4. The natural-sound signal containing the audible sound and the ultrasonic wave within the range of from several tens of KHz to 40 KHz collected by the microphone 201 is converted to the digital signal by the AD converter 202, and is inputted to the frequency divider 203 where the natural-sound signal is reduced by one octave and is converted to the signal within the range of from several tens of KHz to 20 KHz. The signal from the frequency divider 203 is inputted to the DA converter 204 and is converted to the analog signal. The analog signal is recorded onto the magnetic tape of the recording and reproducing unit 205.

At reproducing, the analog signal within the range of from several tens of KHz to 20 KHz read out from the magnetic tape of the recording and reproducing unit 205 is inputted to the AD converter 206. The digital signal from the AD converter 206 is multiplied by one octave by the frequency multiplier 207. The thus obtained digital signal within the range of from several tens of KHz to 40 KHz is inputted to the DA converter 208. The converted analog signal is inputted to the loudspeaker 210 through the amplifier 209, to emit the natural sound including the audible sound and the ultrasonic wave within the range of from several tens of KHz to 40 KHz.

In connection with the above, the recording and reproducing unit is not limited to the analog-type recording and reproducing system, but a digital-audio-recording system capable of recording and reproducing in a digital manner can be applied to the recording and reproducing unit. Further, it is of course that a recording and reproducing system using an optical disc can be applied to the recording and reproducing unit.

Referring next to Fig. 5, there is shown, in a schematic manner, a comfortable-room creating system according to a fourth embodiment of the invention. Although not shown, the comfortable-space creating system illustrated in Fig. 5 comprises its constitution similar to that illustrated in Fig. 1, 2 or 3, and further comprises a indoor-environment producing apparatus which produces indoor environment.

As shown in Fig. 5, in the indoor-environment producing apparatus, a building 301 has its rooftop, and various sensor units are mounted on the rooftop of the building 301. The sensor units include a light and color sensor unit 302 for detecting a light and a color of the natural world, a rainfall sensor unit 303 for detecting a rainfall condition, and so on.

Information from the various sensor units 302 and 303, representing the outdoor condition, is transmitted to a

control unit 304. A control signal regulated or adjusted by the control unit 304 suitably operates or actuates an illumination unit 305 and/or a dummy or suspected rainfall apparatus 306, to reproduce a natural condition of an exterior 308, into each of a plurality of interiors 307 of the building 301.

The outline of the system including the control unit 304 centering around the illumination unit 305 is shown in Fig. 6.

The sensor units 302 and 303 on the rooftop includes an all-daylight sensor 309, a sky-light daylight sensor 310 and a sensor 311 for temperature, humidity and the like. Weather and illuminance of the exterior are detected by these sensors 309, 310 and 311 and are sent to the control unit 304.

The control unit 304 comprises a CPU 312, a data base 313, a timer 314 and a controller 315. The data base 313 has stored therein information regarding an optimum illumination such as color and illuminance with respect to each of conditions such as weather, season, time and so on. The data base 313 supplies the information to the CPU 312 in accordance with request therefrom. The timer 314 transmits information regarding time and schedule operation to the CPU 312. The controller 315 adjusts its output signal in accordance with request from a plurality of adjusting plates 331 and 331 arranged respectively at various locations within the interiors 307 and 307 to supply the output signal to the CPU 312.

A light adjusting signal from the CPU 312 is supplied to the illumination unit 305 which is suitably arranged within the interior 307 through a plurality of distribution switchboards 332 and 332, to practice various illuminations. An example of the various illumination is shown in Fig. 6, and the illumination unit 305 includes an indirect illumination device 316, a ceiling producing illumination device 317, and a wall-surface producing illumination device 318 for giving variation to a wall

surface.

Adjusting of the light and the color of the illumination unit 305 is considered variously, but is set as follows, for example:

(1) Season

Spring: Selection of coloring imaging a color of a flower and fresh verdure;

Summer: Selection of illumination which is a warm color and which is high in color temperature and illuminance;

Fall : Selection of coloring which is emphasized in color of brown circle; and

Winter: Selection of illumination which is a cold color and which is low in color temperature and illuminance.

(2) Time

Morning: Selection of coloring which is low in color temperature and which is light in color;

Noon : Raising of color temperature; and

Evening: Selection of coloring which is low in color temperature and which is dark in color.

(3) Weather

Clear Weather : Selection of blue or white circle; and

Cloudy Weather: Selection of a color circle which is dark.

The suspected rainfall apparatus 306 will next be described with reference to Fig. 7.

The suspected rainfall apparatus 306 is arranged at a corner within the interior 307. The suspected rainfall apparatus 306 comprises a rainfall head 319 arranged on a ceiling of a building and a water tank 321 arranged on a floor of the building. Drops of water 320 from the rainfall head 319 pour on the water tank 321. Various plants 322 are placed within the water tank 321 and are useful for relaxing atmosphere within the interior 307. The pouring water drops 320 wet the plants 322 so that the color of the green is made further clear.

The suspected rainfall apparatus 306 includes a

water level sensor 323 for detecting a water level of the water drops 320 pouring on the water tank 321. The suspected rainfall apparatus 306 further includes a discharge opening 324 which is arranged at a part of the water tank 321. The water drops 320 are removed or discharged through the discharge opening 324.

The suspected rainfall apparatus 306 further includes a water supply or intermediate water equipment, a pipe line 325 connected to the water equipment, and an electromagnetic valve 326 provided in the pipe line 325. Water flow is adjusted by the electromagnetic valve 326 which is open and closed by the control unit 304 receiving the information from the rainfall sensor unit 303. Thus, the water flow is simulated in accordance with the outdoor conditions.

A first modification of the fourth embodiment illustrated in Figs. 5 through 7 is illustrated in Fig. 8 and comprises a color projector 327 in place of the illumination unit 305 shown in Fig. 5. The color projector 327 does not merely adjust a light and a color on the wall surface or on the ceiling, but projects a specific and desirable image onto the wall surface in accordance with a season, a weather and a time. Thus, a natural feeling is further produced.

A second modification of the fourth embodiment illustrated in Figs. 5 through 7 is illustrated in Fig. 9. In the second modification, illumination given to plants or the like such as, for example, a rainfall system or the like is adjusted in light in accordance with conditions of the exterior to produce freshness of morning and an evening relaxed atmosphere in accordance with time.

Referring next to Fig. 10, there is shown a comfortable-space creating system according to a fifth embodiment of the invention. Although not shown, the comfortable-space creating system illustrated in Fig. 10 comprises its constitution similar to that illustrated in Fig. 1, 2 or 3, and further comprises a suspected window 401.

The suspected window 401 comprises a recess 403

which is formed in a wall 402 and which has a depth, a window opening 404 formed by cutting-out of a part of the wall 402 corresponding to the recess 403, a window glass material 405 fitted in the window opening 404, a curved-surface screen 406 formed on a cylindrical bottom wall of the recess 403, and a wide-angle image machine 407 such as a projector, a multi-slide or the like for projecting an image.

As shown in Figs. 11 and 12, a projection image is projected onto the curved-surface screen 406 from the wide-angle image machine 407. In this case, since the curved-surface screen 406 is formed into a cylindrical surface having a depth, the image projected onto the curved-surface screen 406 has its sense of distance and sense of three dimensions even if one sees the image in any directions through the suspected window 401. Accordingly, it is possible to obtain an image such as scenery or the like which is closer to the nature, on the outside of the suspected window 401.

Further, as shown in Fig. 13, arranged within the wide-angle image machine 407 are a film 408, an image selecting unit 409 and a control unit 410. Images such as scenery or the like of respective seasons at spring, summer, fall and winter, images of scenery or the like of respective weathers such as clear weather, cloudy weather, rain, snow and the like, and images of scenery or the like at various times such as morning, noon, night and so on are recorded onto the film 408. The image selecting unit 409 selects a desired image from the various images on the film 408 to set the desired image at a predetermined location of the wide-angle image machine 407. The control unit 410 controls the image selecting unit 409 such that an image substantially the same as an actual outdoor scenic condition is selected on the basis of the actual outdoor scenic condition, that is, on the basis of the actual season, weather, time and so on. Information regarding the actual outdoor scenic condition is supplied to the control unit 410 from an information input unit 411 which is arranged on the outside of the building.

More specifically, as shown in Fig. 14, information regarding weather, temperature, humidity and the like is inputted to a central processing unit 415 from a sensor unit 416. Information regarding a hope or request of a resident within a building is inputted to the central processing unit 415 from a controller 417. Information regarding time is inputted to the central processing unit 415 from a timer 418. The central processing unit 415 processes these information, and determines selection of an optimum image software of a data base 419, or utilization of an image of an outdoor television monitor of the sensor unit 416, on the basis of the processing results. The decided image is sent to an image machine 420. The image machine 420 projects the sent image onto the suspected window. In the case where a plurality of suspected windows are arranged continuously or in side by side relation, the central processing unit 415 computes an optimum software to send the same to the image machine 420.

By doing so, the image projected onto the curved-surface screen 406 varies depending upon the outdoor scenic condition. Thus, scenery further closer to the natural scenery is formed on the suspected window 401.

Moreover, a static image can be used as an image projected onto the curved-surface screen 406. Alternatively, a dynamic image or animation can be used as the image projected onto the curved-surface screen 406. In the case where the dynamic image is projected, it is possible to produce "fluctuation". Thus, scenery further closer to the natural scenery can be obtained.

Fig. 15 shows a first modification of the fifth embodiment illustrated in Figs. 10 through 14.

As shown in Fig. 15, in the first modification, the plurality of aforesaid suspected windows 401 and 401 are formed at a relatively long wall such as, for example, a wall extending along a passage 412. Projected images in the suspected windows 401 and 401 arranged adjacent each other are formed into a continuous image. That is, it is supposed

that a passerby M walks along the passage 412 from the left to the right. Then, setting is made such that the passerby M is able to see a portion X of an image projected onto the curved-surface screen 406 through the window glass material 405 at a location $B_{\&AA}$. It is also supposed that a portion including a part X_1 of the portion X and a part Y_1 contiguous to an end of the portion X is formed into a portion Y. Then, when the passerby M existing at the location $B_{\&AA}$ sees the next or adjacent suspected window 401, the portion Y is projected onto the curved-surface screen 406 of the adjacent suspected window 401 such that the portion Y is seen through the adjacent suspected window 401. As the passerby M further moves to the right, the image, which the passerby M sees, is changed from the image on the portion Y of the adjacent suspected window 401 to an image on a portion Z. Setting is made such that, when the passerby M reaches a point $B_{\&BA}$, the passerby M is able to see the portion Z. In this manner, when the passerby M moves from the left to the right, it is possible for the passerby M to enjoy, through the continuous suspected windows 401 and 401, scenery of an image having the portion X, the portion Y and the portion Z which are continuous to each other. Further, when the passerby M moves in the reverse direction, that is, from the right to the left, it is possible for the passerby M to similarly enjoy scenery of the image having the portion Z, the portion Y and the portion X which are continuous to each other.

By the formation of the continuous image in the manner described above, it is possible to further approach the actual window scenery.

Other than the passage 412 that is the location where the suspected windows are provided in a continuous manner, as shown in Fig. 16, it is possible to provide the suspected windows 401 and 401 on a wall 414 beside an escalator 413. In this case, if the series of suspected windows 401 and 401 are provided in an inclined manner in agreement with the inclination of the escalator 413, it is possible to enjoy scenery of the suspected windows 401 and

401 in a continuous manner as the escalator 413 proceeds.

Fig. 17 shows a second modification of the fifth embodiment illustrated in Figs. 10 through 14. In Fig. 17, components and parts like or similar to those illustrated in Figs. 10 through 14 are designated by the same or like reference numerals, and the description of the like or similar components and parts will be omitted to avoid repetition.

As shown in Fig. 17, in the second modification, the curved-surface screen 406 is formed into a spherical surface. By the formation of the curved-surface screen into the spherical surface, it is possible to see an image even if one sees the suspected windows 401 and 401 from a diagonally lower location or from a diagonally upper location.

Referring next to Figs. 18 and 19, there is shown a comfortable-space creating system according to a sixth embodiment of the invention. Although not shown, the comfortable-space creating system illustrated in Figs. 18 and 19 comprises its constitution similar to that illustrated in Fig. 1, 2 or 3, and further comprises a suspected window 510. Fig. 18 is a vertical cross-sectional view of the suspected window 510, while Fig. 19 is a perspective view of the inner side of the suspected window 510.

The suspected window 510 is formed in a no-window outer wall 502 made of reinforced concrete or the like, of a no-window building 501. A trim wall 503 is built on the inside of the outer wall 502 correspondingly to a post, and is finished in agreement with an interior 504. An exterior is designated by the reference numeral 505, while an indoor floor is designated by the reference numeral 506. A space 507 is formed between the outer wall 502 and the trim wall 503.

In the suspected window 510 of the comfortable-space creating system according to the sixth embodiment of the invention, an auxiliary wall 511 is provided on the inside of the outer wall 502 with the space 507 having a predetermined interval or spacing defined between the outer

wall 502 and the auxiliary wall 511. The auxiliary wall 511 serves also as the trim wall 503. The auxiliary wall 511 is arranged also in a direction partitioning the space 507, and serves as a partition wall 512 of the space 507.

As shown also in Figs. 18 and 19, the auxiliary wall 511 is formed therein with an opening 520 which has its width a and its height b. A window frame 521 is mounted to the opening 520. The window frame 521 is a double-leaf door, for example, in which a side frame 522 is hinged through a hinge 523, and a glass material 524 is fitted in the side frame 522 and is openable with respect to the opening 520.

A reflecting mirror 530 inclined outwardly is arranged between the outer wall 502 and the auxiliary wall 511 in vertically diagonally facing relation to the opening 520. The reflecting mirror 530 has its width a and its height b which correspond to the opening 520 at the front face. An upper edge 533 is supported by the auxiliary wall 511 in such a manner that a front side or face 531 faces downwardly and a rear side or face 532 faces upwardly. A lower edge 534 is supported by the outer wall 502, and the reflecting mirror 530 is mounted obliquely at about 45B !kA in accordance with the standards at the time a spacing d is equal to the height b. It is preferable that the reflecting mirror 530 is mounted detachably. The reflecting mirror 530 is available as a commercial mirror.

An illumination equipment 540 is arranged below the reflecting mirror 530 at a location within the space 507. The illumination equipment 540 comprises a luminaire 541 which serves as direct illumination. Further, as shown in Figs. 18 and 19, the luminaire 541 is embedded in the outer wall 502 or the auxiliary wall 511 and serves as indirect illumination. It is of course that the illumination equipment 540 forms a part of an illumination equipment for the building 501. The illumination equipment 540 has its ability sufficient to illuminate the interior 504. It is preferable that a plurality of daylight lamps are used as the luminaire 541.

With the arrangement described above, it is possible to illuminate the interior 504 through the reflecting mirror 530. Simultaneously, the interior 504 is illuminated just like the natural lighting from the exterior 505.

A molding article 550 is arranged within the space 507 as a component of the illumination equipment 540. As the molding article 550, a flowering plant put in a planter for a close-range view, a suspected tree 551 in which a plantation is formed by natural or suspected trees, a suspected building 552, a cloud, mountain, skyline or the like 553 for a distant view are formed in a suitable reduced scale. Articles are supported such that natural postures of the respective article, which are vertical, are supported horizontally. It is of course that a scene with respect to the reflecting mirror 530 is considered also to the construction of the planes of the partition wall 512 and the floor 506.

Further, it is needless to say that the basic or fundamental reflecting mirror 530 is changed in inside and outside, and a second illumination equipment 542 and the molding article 550 are arranged above the reflecting mirror 530.

Furthermore, as the reflecting mirror 530 arranged within the space 507, it is possible to use a mirror known as "magic mirror". The magic mirror is a normal or ordinal mirror at its front face 531, but is transparent in light at its rear face 532. If the magic mirror is used, the illumination equipment 540 and the molding article 550 are arranged above and below or on both sides of the reflecting mirror 530, by arrangement of a reflecting mirror 535 on the plane of the floor 506 within the space 507.

Moreover, as shown in Fig. 19, a general air conditioning equipment 560 of the building 501 has its blowing port or suction port which is arranged within the space 507. A louver 561 is arranged, for example, below the partition wall 512, and is connected to a duct space 562.

It is of course that the suspected window 510 of

the comfortable-space creating system according to the sixth embodiment is not limited to the above-described specific example. The invention is not limited to the building which is formed with no window in view of its function. The invention is applicable to a portion of the building where a living room having no window is formed by the partition wall within the room, or is applicable to the originally underground room.

The suspected window 510 of the comfortable-space creating system is substantially the same in basic construction as the ordinary or usual window. Thus, the invention will be understood chiefly by the description of the function of the reflecting mirror 530 and the description of the use thereof.

The suspected window 510 of the comfortable-space creating system according to the sixth embodiment of the invention is constructed by the utilization of the space 507 between the outer wall 502 and the auxiliary wall 511. Accordingly, an establishment floor area having the spacing $\underline{d}$ is necessary. However, the spacing $\underline{d}$ is used to give verisimilitude as the depth $\underline{d} + \underline{x}$ to the suspected window 510. By the reflecting mirror 530 and the illumination equipment 540 which are arranged within the space 507, a lighting source is formed in which the opening 520 is similar to the usual or normal window. By existence of the light, a feeling of liberation is unconsciously given from a closed space. Particularly, if the ordinary or usual window frame 521 mounted to the opening 520 is open, the supply air from the air conditioning equipment 560 is fed into the interior 504 similarly to the outdoor air without change in a general window sash, so that freshness similar to the outdoor wind is felt. Thus, existence of the window is felt which is not considered as being the suspected window.

Next, although being simple and clear from a viewpoint of principle, illumination due to the illumination equipment 540 and formation of the outdoor scenery will be described.

As shown in Fig. 20, a plurality of suspected woods 551, a suspected building 552 and so on as the molding article 550 are formed in a suitably reduced scale in accordance with a close-range view, a distant view and so on, and is arranged horizontally with an inner surface side of the outer wall 502 being a proximal end. When the molding article 550 is illuminated by the illumination equipment 542, the illuminating light is reflected from the surface 531 at the lower surface of the reflecting mirror 530, so that an image S under the vertical condition is seen from the side of the interior 504. The height x of the space 507, within which the various molding articles are arranged, is such that an upper part is seen as being a close-range view in accordance with far and near. Thus, it is considered that the suspected woods 551 like a planter is the actual scenery near the outside of the window.

Further, under the action of the air conditioning equipment 560, the shaking is given to the suspected woods 551 due to wind. Thus, reality is further added.

Here, if the magic mirror is used as the reflecting mirror 530, the reflecting mirror 530 acts double. For instance, the distant view 553, which is brought to a background like cloud, mountain or skyline, is optionally illuminated by a color on the cover 543 of the second illumination equipment 542. An image of the distant view 553 is transmitted through the reflecting mirror 530 only by a distance z downwardly from the rear surface 532. The image is reflected from the usual horizontal reflecting mirror 535 which is mounted to the floor 506. The image similarly reaches the surface 531 of the reflecting mirror 530, while the image is composed including the image of the suspected woods 551 and the like. As will be clear from Fig. 20, the passing distance of the image S is brought to x + z and is projected onto the interior. Simultaneously, a feeling of liberation is provided as an advantage of the window. During this, the images of the suspected articles 551 and 552 are superimposed upon each other. Thus, a small number of

molding articles 550 may be used.

CLAIMS

1. A system for creating a comfortable space, comprising:

environment extracting means for extracting, as input information, at least two environmental factors within a space, which include a factor representing a man's activity;

environment computing means for determining an optimum combination of the environmental factors on the basis of the information obtained by the environment extracting means; and

environment control means for outputting a new environmental factor to the space on the basis of control information from the environment computing means.

2. A system according to claim 1, wherein the environment extracting means extracts a plurality of environmental factors on the outside and inside of the space.

3. A system according to claim 1 or 2, wherein the environment extracting means includes outdoor environment extracting means for extracting at least one outdoor environmental factor, man's activity extracting means for detecting a condition of the man's activity within the space, database means for storing therein space factors given beforehand in agreement with a use of the space, and at least one indoor sensor for detecting an indoor environment condition.

4. A system according to claim 3, wherein the outdoor environment extracting means extracts a plurality of factors including outdoor temperature, humidity, radiation, wind velocity, wind pressure, brightness and luminosity, and wherein the environment control means

controls an indoor environment within the space on the basis of an output signal from the outdoor environment extracting means.

5. A system according to claim 3 or 4, wherein information stored in the database means includes a use of the space, conditions of location, a season, and organisation of an intended group of persons.

6. A system according to claim 5, wherein the organisation of the intended group of persons includes the distinction of sex and age.

7. A system according to any of claims 3 to 6, wherein the indoor sensor detects environmental conditions within the space, which include temperature, humidity, radiation, luminous intensity, a sound level and aroma.

8. A system according to any preceding claim, wherein the environment control means includes a plurality of environment control instruments.

9. A system according to any preceding claim, wherein the environment computing means computes optimum environment within the space on the basis of variable data and data of the database means, the variable data including outdoor environment, indoor environment and man's motion, and wherein a signal is sent from the environment computing means to the environment control means.

10. A system according to claim 8 or claim 9 as dependent thereon, wherein the environment control means controls the environment control instruments having their variable outputs, on the basis of the signal from the environment computing means.

11. A system according to any preceding claim, wherein the environment control means includes air conditioning means for adjusting indoor temperature within the space, wherein the environment extracting means includes an indoor temperature sensor mounted at a predetermined location within the space, for detecting the indoor temperature within the space, and a body-surface temperature sensor for detecting temperature of a body surface of a man existing within the space, and wherein the environment control means further includes a control unit for controlling the air conditioning means on the basis of the indoor temperature from the indoor temperature sensor and the temperature of the body surface from the body-surface temperature sensor such that the indoor temperature is brought to a predetermined value.

12. A system according to claim 11, wherein the environment extracting means further comprises an outdoor temperature sensor for detecting outdoor temperature on the outside of the space, and wherein the control unit controls the air conditioning means on the basis of a temperature difference between the outdoor temperature from the outdoor temperature sensor and the indoor temperature from the indoor temperature sensor.

13. A system according to claim 11 or 12, wherein the air conditioning means air-conditions only a specific area within the space.

14. A system according to any preceding claim, further comprising stress relaxing means due to a high-frequency natural sound, the stress relaxing means including a microphone for absorbing the natural sound within a range of from several tens of kHz to 40 kHz, to issue an output signal, an AD converter into which the output signal from the microphone is inputted, a digital type

frequency divider for reducing frequency of an output signal from the AD converter by one octave, a recording medium for recording and reproducing an output signal from the digital type frequency divider in one of an analogue manner and a digital manner, a digital type frequency multiplier for multiplying a readout signal from the recording medium by one octave, a DA converter into which an output signal from the digital type frequency multiplier is inputted, and an electric sound converter for emitting an output signal from the DA converter as the natural sound having its frequency within the range of from several tens of kHz to 40 kHz.

15. A system according to claim 14, wherein the stress relaxing means includes a further DA converter interposed between the digital type frequency divider and the recording medium for converting the output signal from the digital type frequency divider into an analogue signal.

16. A system according to claim 14 or 15, wherein the recording medium is a magnetic tape for recording thereon the analogue signal from the second DA converter.

17. A system according to claim 14, 15 or 16, wherein the stress relaxing means includes a further AD converter interposed between the recording medium and the digital type frequency multiplier for converting the analogue signal read out from the recording medium into a digital signal.

18. A system according to any of claims 14 to 17, wherein the stress relaxing means further includes an amplifier interposed between the first-mentioned DA converter and the electric sound converter for amplifying the output signal from the first-mentioned DA converter.

19. A system according to any preceding claim, wherein the environment control means further comprises simulation means for simulating an outdoor natural environment into the space on the basis of the information from the environment extracting means.

20. A system according to claim 19, wherein the environment extracting means includes at least one outdoor sensor for detecting the outdoor natural environment.

21. A system according to claim 19 or 20, wherein the environment extracting means detects an outdoor light and an outdoor colour, and wherein the simulation means simulates the outdoor natural environment into the space on the basis of an output signal from the environment extracting means.

22. A system according to claim 19, 20 or 21, wherein the environment extracting means detects an outdoor rainfall condition, and wherein the simulation means simulates the outdoor natural environment into the space on the basis of an output signal from the environment extracting means.

23. A system according to any of claims 19 to 22, wherein the environment extracting means includes a light and colour sensor for detecting a light and a colour of a natural world, and a rainfall sensor for detecting an outdoor rainfall condition, and wherein the simulation means simulates the outdoor natural environment into the space on the basis of an output signal from the light and colour sensor and an output signal from the rainfall sensor.

24. A system according to any of claims 19 to 23, wherein the simulation means includes at least one of an

illumination apparatus and an artificial rainfall apparatus.

25. A system according to claim 24, wherein the environment computing means includes control means which comprises a central processing unit, a database connected to the central processing unit, the database having stored therein optimum information regarding optimum illumination with respect to various conditions including a weather, a season and a time, the database supplying the optimum information to the central processing unit in accordance with a request from the central processing unit, a plurality of regulators arranged respectively at a plurality of locations within the space, and a controller for adjusting outputs from the respective regulators to issue an output signal which is supplied to the central processing unit.

26. A system according to claim 25, wherein the illumination apparatus includes an indirect illumination unit, an illumination unit for producing a ceiling of the space, and an illumination unit for producing a wall surface of the space.

27. A system according to any of claims 19 to 26, wherein the environment control means includes an artificial rainfall apparatus arranged within the space, the artificial rainfall apparatus comprising a rainfall head arranged on a ceiling of the space and a water tank arranged on a floor of the space, and wherein drops of water from the rainfall head pour on the water tank.

28. A system according to claim 27, wherein the environment control means further includes a water level sensor for detecting a water level of the water drops pouring on the water tank, and a discharge opening arranged in a part of the water tank, the drops of water

being discharged through the discharge opening.

29. A system according to claim 22, or any claim dependent thereon, wherein the environment control means further includes a water instrument, a pipe line connected to the water instrument, and an electromagnetic valve which is open and closed in response to the output signal from the rainfall sensor.

30. A system according to any of claims 19 to 29, wherein the environment control means includes a colour projector for projecting a specific and desirable image onto a wall surface of the space in accordance with a season, a weather and a time.

31. A system according to any of claims 19 to 29, wherein the environment control means gives illumination to a plant, the illumination given to the plant being adjusted in light in accordance with conditions on the outside of the space to produce freshness of morning and an evening relaxed atmosphere.

32. A system according to any preceding claim, further including at least one artificial window which comprises a recess provided in a wall of the space, the recess having an opening, a curved surface screen formed in a bottom wall of the recess in a curved surface manner, an image machine for projecting an image onto the curved surface screen, and a window glass material mounted to the opening of the recess.

33. A system according to claim 32, wherein the curved surface screen is in the form of a cylindrical surface.

34. A system according to claim 32, wherein the curved surface screen is in the form of a spherical surface.

35. A system according to any of claims 32 to 34, including a plurality of artificial windows arranged in side by side relation to each other.

36. A system according to claim 35, wherein the image machine is set such that a continuous image is projected onto the curved surface screens of the respective artificial windows which are arranged in a continuous manner.

37. A system according to any of claims 32 to 36, wherein the image, which is projected onto the curved surface screen, varies depending upon an actual outdoor scenic condition.

38. A system according to any of claims 32 to 36, wherein the image, which is projected upon the curved surface screen, is an animation.

39. A system according to any preceding claim, further including an artificial window forming a window without provision of an opening in a windowless wall of the space, the artificial window comprising an auxiliary wall provided on an inner surface of the windowless wall with spacing defined between the inner surface and an outer surface of the windowless wall, an opening formed in the auxiliary wall, a reflecting mirror unit arranged within the spacing and inclined outwardly such that a front face of the reflecting mirror unit faces toward the opening, and illumination equipment arranged within the spacing in facing relation to the front face of the reflecting mirror unit.

40. A system according to claim 39, wherein the illumination equipment includes scale reduced elements which include artificial woods, artificial buildings and/or cloud, as a plurality of moulding articles

copying an outdoor scene.

41. A system according to claim 39 or 40, wherein the reflecting mirror unit has its rear face which is translucent in light, wherein the illumination equipment includes a pair of illumination units, and wherein the pair of illumination units and the moulding articles are arranged on both sides of the reflecting mirror unit.

42. A system according to any of claims 39 to 41, wherein the opening of the auxiliary window is provided with an ordinary window sash.

43. An environment control system for a living space, comprising means to measure at least two environmental factors in the space relevant to the human condition, means to determine the optimum combination of the factors based on the measured values, and means to optimise the factors accordingly,

said system optionally further comprising any one or more suitable features as defined in any preceding claim, in any suitable combination.

44. An environment control system for controlling at least two factors of an environment, substantially as hereinbefore described.

45. A system substantially as hereinbefore described, with reference to Figure 1.

46. A system substantially as hereinbefore described, with reference to Figure 2.

47. A system substantially as hereinbefore described, with reference to Figure 3.

48. A system substantially as hereinbefore described,

with reference to Figure 4.

49. A system substantially as hereinbefore described, with reference to Figures 5 to 8.

50. A system substantially as hereinbefore described, with reference to Figures 5 to 7 and 9.

51. A system substantially as hereinbefore described, with reference to Figures 10 to 16.

52. A system substantially as hereinbefore described, with reference to Figures 10 to 14 and 17.

53. A system substantially as hereinbefore described, with reference to Figures 18 to 20.

54. A space or structure comprising a system according to any preceding claim.

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